THE IRON TRADE REVIEW

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STRONG CONDITIONS

CONTINUE TO CHARACTERIZE THE MARKET.

Higher Prices of Finished Materials Do Not Check Demand.—Making of Contracts for Castings Will be a Test.

The market continues exceedingly strong, but the tendency of high prices to check consumption, as noted last week, is still felt in some lines. If there is any soft spot at present, it is in structural shapes. Mills generally admit that orders on hand are not very large and that specifications are coming in slowly, but the sales of the principal producer for November were nearly up to the capacity of its plants, and its confidence in future demands is shown by the decision to erect two new structural mills. The building program of the steel corporation has been anticipated to a considerable extent, but there are some surprises.

Pig Iron is Strong. Prices of pig iron show little change, but there is a tendency toward higher prices, especially on the southern product. The Tennessee-Republic interests have withdrawn from the market for the first half. Four blast furnaces in the south have been compelled to blow out for repairs, and, on account of shortage of raw material, others are in danger of stopping. One blast furnace at Buffalo has also been compelled to blow out for relining, and it is doubtful whether the new capacity coming in during the next few months will be more than enough to offset the curtailed production of furnace interests whose plants will require repairs. A few foundries in the central west have found it impossible to conduct business profitably at prevailing prices of pig iron and castings. Many new contracts for castings will be made early in the new year, and this test will show pretty closely whether prices of pig iron for the second half of the year can be maintained at present levels.

Relative Prices. Recent advances in finished lines have not, so far as can be ascertained up to date, checked the demand, except in the case of cast iron pipe. The prices being received for raw and semi-finished material are still considerably higher relatively than those of a number of kinds of finished material. With Bessemer billets and sheet bars selling at about $30, the independent interests which are compelled to buy their semi-finished material find it necessary to do some pretty close figuring.

Not Enough Plates. Plate mills are unable to keep up with the demand and in the Pittsburg district the plant of a large steel car-building concern was compelled to close for two days on account of lack of material. The sheet market is very active and an advance in prices is anticipated. Specifications on iron and steel bars are showing a tendency to decrease. Sales of tin plate by the principal producer last month were the heaviest of any November in the history of the company.

Iron Ore Shipments. Owing to the extremely cold weather at Lake Superior ports, the shipping of ore has almost entirely ceased. The total for the season will be about 37,250,000 tons, and some independent furnace interests fear that they will not obtain an adequate supply. The shipments for November were 3,734,167 tons, against 3,341,229 tons in November, 1905.

SERIOUS CAR SHORTAGE.

New York, Dec. 12.—The representative of a leading independent steel interest says: "The car situation could not be worse. There are only half enough cars in the country to do the business."

Late rail sales are as follows: Detroit, Toledo and Ironton, 6,000; Duluth and Northern Minnesota, 1,000; Pacific Traction Co., 1,000; Georgia and Florida, 33,000; scattering, 5,000.

SEVEN BLAST FURNACES

AND THIRTY-FOUR OPEN-HEARTH PLANTS ARE AUTHORIZED

By the United States Steel Corporation.—Two Structural Mills, One Merchant Bar Mill and Other Plants Will Also be Built.

New York, Dec. 12.—An official list of the principal improvements authorized for 1907 by the United States Steel Corporation has been issued. In addition to what has already been announced, these improvements are as follows:

Carnegie Steel Co.

At the Ohio works two new blast furnaces, 12 open-hearth furnaces, blooming mill and bar mills of sufficient capacity to finish the product of the open-hearth plant and a new mold foundry.

At the Clairton works a new 14-inch structural mill, a new 22-inch structural mill and a 1,000 kilowatt generator with gas engine.

At the Duquesne works a new 16-inch merchant bar mill and a new electric power station.

At the Bellaire works a new river pumping plant.

Indiana Steel Co.

Commencing work at Gary on the second group of four blast furnaces, 28 open-hearth furnaces, blooming and slabbing mills and other finishing mills necessary to handle the steel produced.

Illinois Steel Co.

Two 250-ton mixers for the Bessemer department and a new 40,000,000 gallon pumping engine.

National Tube Co.

At the Lorain works a new blast furnace and six open-hearth furnaces with a new galvanizing plant.

American Sheet & Tin Plate Co.

At the Guernsey works, Cambridge, O., four new hot mills.

At New Philadelphia, O., the reconstruction of the plant and the addition of one jobbing mill and one sheet mill.

At the Scottdale works a new galvanizing plant and the reconstruction of mills.

(Continued on page 15.)

THE WEEK IN IRON CENTERS.

PITTSBURG.

Some Inconsistencies of a Strong Market.—Ore Shortage is Predicted.

Office of THE IRON TRADE REVIEW, 521 PARK BUILDING, Dec. 12.

Inability to get finished material on specifications against contracts is the story of nearly every consumer of steel and the complaint is more or less general in every branch of the business. In the larger lines, steel plates are the hardest to obtain and items under the bar schedule are in a like condition. Because of a shortage in the supply of steel plates, the largest consumer in this district has been running on a close margin and was shut down entirely for two days last week because it could not get the material. This is not entirely due to car shortage, which is not any worse now than it has been for a month, but the exceedingly heavy demand from all sources has placed the mills in a position where they must distribute the output and all consumers are receiving less than their specifications. The heaviest consumers of steel plates are the steel car companies, with lake ship yards second and the pipe making interests third and all are being handicapped.

Market conditions are excellent, particularly from a selling standpoint but occasion has been taken to point out the contradictory features, the most marked of which are the high prices being asked for raw and semi-finished material as compared with the prices of finished material. Bessemer billets are selling at $29.50 to $30 and sheet bars at the later figure, while finished steel bars are quoted 1.60c base. How independent interests buying their semi-finished material in the open market can manufacture at a profit on the margin is the rebus.

There have been no further advances in prices of finished material during the week under review, although they are anticipated in sheets and tin plate before the beginning of the new year.

With the season of navigation closed as far as further shipments of ore are concerned, there is a strong inquiry for iron ore by merchant furnaces and a marked scarcity is predicted before the middle of next April when the ore will begin to come down from the head of the lakes next year.

Pig Iron.—There has been comparatively little inquiry except for occasional small lots of foundry iron for spot shipment and this is bringing fancy prices to those who have it to sell. For December shipment $26, valley furnace, has been paid and first quarter iron is held at $25 to $25.50, valley, while second quarter northern foundry iron is quoted $23 to $23.50, valley, with but very little to offer at these prices. One small lot of Bessemer pig iron sold during the week for first quarter delivery at $23, valley, and this price is being quoted on what second quarter iron is being offered. A lot of 1,000 tons of Scotch No. 3 foundry iron for spot delivery has been sold at $24.75 f. o. b. cars, Philadelphia, and taking a $2.20 freight rate to the Pittsburg district. This iron runs 0.60 phosphorus, 2.75 silicon, 0.035 or under in sulphur and 1 to 1.30 manganese. For similar shipment 1,000 tons of English No. 3 Middlesborough iron sold at $22.75 f. o. b. cars, Philadelphia. The announced advance in freight on southern iron will become effective Jan. 1 on Birmingham iron and Feb. 1 on Virginia iron. The Hall furnace and Hazelton No. 3 of the Republic Iron & Steel Co., will be blown in about Dec. 15, the former after extensive repairs which will increase capacity, and the latter a new furnace. There are several new furnace projects being talked over, report having it that the steel corporation will soon announce appropriations for four new furnaces. In reply to the rumor that the Pittsburg Steel Co., is contemplating the erection of two or three blast furnaces at Monessen, officials of the company say there is nothing to it at this time that can be made public.

Southern blast furnaces are badly handicapped by insufficient railroad facilities to move their iron and while the iron is ready for shipment and piled up at the furnaces, deliveries cannot be made, car shortage being one reason, but the greatest cause advanced is an inadequate motive power equipment. With improved railroad conditions, a large tonnage will probably be delivered six weeks or two months after it is due and have the result of breaking prices. For first quarter delivery we quote as follows:

Bessemer Valley	22.00 to 23.00
Bessemer, Pittsburg	22.85 to 23.85
No. 1 Foundry, Pittsburg	24.35 to 24.60
No. 2 Foundry, Pittsburg	23.85 to 24.35
Gray Forge, Pittsburg	22.85 to 23.35
Basic, Valley	22.00 to 22.50
Basic, Pittsburg	22.85 to 23.35

Ferro-Manganese.—For prompt delivery in carload lots, ferro-manganese, foreign, 80 per cent is quoted $85, delivered Pittsburg and for forward delivery $80 to $82.50. Fifty percent imported ferro-silicon is quoted $108 to $110 and 12 per cent $36, Pittsburg.

Muck Bar.—There has been very little inquiry for muck bar, but all pig metal bar is quoted nominally $36 to $36.50 and scrap bar about $3 less.

Skelp.—The crowded condition of plate mills has made skelp plate a scarce article and there is a tremendous demand for it by pipe mills to supply the big pipe tonnage now being specified. On the light gauges and narrow widths we quote nominally as follows:

Bessemer grooved, 1.70c to 1.75c; sheared, 1.70c to 1.75c; basic, grooved, 1.80c to 1.85c; sheared, 1.75c to 1.80c; iron skelp, 2.15c to 2.25c.

Steel.—Bessemer billets are quoted nominally $29.50 to $30, Pittsburg, and open-hearth billets $32 to $33 and there are but very few to be had at these prices, in fact finishing mills can hardly afford to pay these prices with existing market on finished material. The differential between billets and sheet and tin bars has dropped out of sight. Not since 1902 has there been so much new steel capacity erected by independent interests and several new projects, particularly open-hearth furnaces are under way or contemplated. This is especially true of sheet and tin plate mills and steel foundries.

Plates.—The output of the mills is not sufficient to meet the specification requirements, this being particularly true of the steel car manufacturers, pipe makers and lake ship builders, and complaint is being heard that structural shops are not getting enough plates to keep them going. One large steel car plant in the Pittsburg district was shut down two days last week on this account and pipe mills have complained for some time past on an insufficient supply of plates. The Carnegie Steel Co. has not advanced to the 1.70c base but will not accept further business. Independent plate makers are quoting 1.70c minimum in the Pittsburg district, while eastern mills are asking $2 in advance of this price. We quote as follows:

Tank plate ¼-inch thick, 6¼ to 100 inches, 1.70c f. o. b. mill, Pittsburg. Light plate schedule, No. 10, 1.80c; Nos. 11-12, 1.85c; Nos. 13-14, 1.90c; Nos. 15-16, 2c. Extras on the regular plate schedule are as follows per 100 pounds: boiler and flange steel plates 0.10c; A. B. M. A. and ordinary

firebox steel plates, 0.20c; still bottom steel, 0.30c; marine steel, 0.40c; locomotive firebox steel, 0.50c; all sketches, excepting straight taper plates varying not more than four inches in width at ends, narrowest end not being less than 30 inches, 0.10c; complete circles, 0.20c. Plates in width over 100 inches up to 110 inches, 0.05c; over 110 inches up to 115 inches, 0.10c; over 115 inches up to 120 inches, 0.15c; over 120 inches up to 125 inches, 0.25c; over 125 inches up to 130 inches, 0.50c; over 130 inches, 1.00c. Gauges under ¼-inch to and including 3-16-inch plates on thin edges, 0.10c; under 3-16 inch to and including No. 8, 0.15c; under No. 8 and including No. 9, 0.25c. Five cents extra for less than carloads. Terms, net cash in 30 days.

Sheets.—There has been no change in sheet prices although announcement of one is expected on account of the very heavy tonnage now on the books of the producers. Painted and galvanized roofing sheets are very active along with light and heavy sheets. Despite the fact that this is the season of the year when a period of inactivity is expected, there has been no decrease in the volume of business and this is the unusual feature of the situation. For prompt deliveries some slight premiums have been paid, but this is not general, as very few producers are in shape, in the ordinary course of business, to make anything like prompt deliveries. We quote as follows:

Black steel sheets, one pass, cold rolled: Nos. 11-12, 2.20c; Nos. 13-14, 2.25c; Nos. 15-16, 2.30c; Nos. 17-21, 2.35c; Nos. 22-24, 2.40c; Nos. 25-26, 2.45c; No. 27, 2.50c; No. 28, 2.60c; No. 29, 2.75c; No. 30, 2.85c; galvanized, Nos. 10-11, 2.55c; Nos. 12-14, 2.65c; Nos. 15-16, 2.75c; Nos. 17-21, 2.90c; Nos. 22-24, 3.05c; Nos. 25-26, 3.25c; No. 27, 3.45c; No. 28, 3.65c; No. 29, 3.90c; No. 30, 4.15c. Corrugated roofing, $1.85 per square for No. 28 painted, 2½ inch corrugation and $3.15 per square No. 26 galvanized, 2½ inch corrugation. Blue annealed sheets, No. 10 and heavier 1.80c; Nos. 11-12, 1.85c; Nos. 13-14, 1.90c; Nos. 15-16, 2c.

Tin Plate.—From a standpoint of new business last month was the largest November the leading interest has had since its organization. Although this is usually the dullest period of the year during ordinary times, there has been a fair tonnage placed with the mills, largely by consumers who have discovered their original contracts will not cover their requirements and they are placing supplementary orders. This has also had an influence on first quarter business, for which delivery additional business, is being placed. Although consumers and independent interests have been expecting another advance in prices, the leading interest has taken no action. We quote:

Coke tin plate, 100-pound basis, 14 x 20, $3.90 f. o. b. mill, Pittsburg district. Terms, 30 days, less two per cent for cash in 10 days.

Merchant Bars.—There has been a slight let-up in the new tonnage on steel bars, presumably on account of a large majority of buyers having covered for their requirements, but the business being placed is still good and mills are filled for several months ahead, about the best deliveries from regular sources being three to four months. The market is still 1.60c base for forward deliveries although 1.90c has been paid for prompt shipments by consumers anxious to secure the material and secured it from a source that seeks premium business. Common iron bars are moving freely and during the past week 10,000 tons was sold into western territory on the basis of 1.60, Pittsburg, plus freight to point of delivery, most of this being made in mills west of Pittsburg. We quote:

Common iron bars, 1.80c in carload lots, 1.85c in less than carloads; Bessemer steel bars, 1.60c, plow and cultivator, 1.60c, net; channels, angles, zees, tees, under three inches, 1.70c, all f. o. b. Pittsburg. The following differentials are maintained on steel; less than 2,000 pounds, 0.10c advance; less than 1,000 pounds of a size 0.30c advance. Cold rolled and ground shafting, 50 per cent off in carload lots, and 5 per cent off in less than carloads, delivered in base territory; open-hearth spring steel, 2.25c to 2.50c, sleigh shoe flats, 1.60c to 1.65c; smooth finished machinery steel, 1.90c to 2c; toe calk, 2.10c to 2.15c. The price of planished and machine straightened tire is 1.80c, base, half tire extras. Iron finished tire up to 1½ inch by ½ inch, 1.75c base half extra, tire list. Iron tire 1½ inch by ½ inch and over to be sold on regular bar basis of 1.60c base, half extras, steel card.

Rails and Track Material.—The business for the week under review has been light as far as standard section rails are concerned, and local mills booked only about 8,000 tons. About 2,000 tons of light rails were placed. The inquiry has been fair, amounting to something like 40,000 tons, but the actual contracts between this and the first of the year will probably be light. Railroad spikes, both iron and steel, are still in very strong demand. We quote as follows:

Fifty pounds and heavier, 500-ton lots and over, $28; carloads and less than 500 tons, $30; less than carload lots, $32; light rails, 16 pounds, $33; 20 to 45 pounds, $32; angle bars for standard sections, 1.65c; spikes, $2.50 to $2.75 for forward deliveries.

Hoops and Bands.—There is a good average demand for hoops and bands, but it is not large in the way of new business, although specifications are heavy and mills are comfortably filled up. We quote:

Hoops, in carload lots, 2c; in less than carload lots, 2.10c; bands, 1.60c base, half extras as per standard steel card. Prices f. o. b. Pittsburg.

Structural Material.—There has been a steady improvement in the demand for structural material for the past month for forward deliveries, but the new business taken by construction companies and the American Bridge Co., has not been heavy; in fact, this class of business has been comparatively slow. The amount of unfinished construction work is still enormous, and will take practically six months to complete if no further business were taken. Prices at the mill on structural shapes have not advanced and we quote unchanged as follows:

Beams and channels, 15-inch, and under, 1.70c; over 15 in., 1.80c; zees, 1.70c; tees, 1.75c; angles from three to six inches inclusive 1.70c; over six inches, 1.80c; universal and sheared plates, 6¼ inches and wider, 1.60c base.

Wire and Wire Nails.—It is too early as yet to tell whether the advance of $2 a ton last week has had any effect on the market in checking the buying is concerned, but even if it does, the check will not be felt for some time to come on account of the big tonnage that has been placed for delivery during the next 60 days. Fencing is in strong demand, and the wire nail tonnage is far in excess to the usual business at this time of the year. We quote:

Wire nails, jobbers' carload lots, $2; retailers' carload lots, $2.05; less than carloads $2.10; painted barb wire, $2.15; for jobbers in carloads, retailers in carloads, $2.20; and less than carloads, $2.30, with 30c for galvanizing; plain wire, $1.85 for jobbers and $1.90 by carload.

Merchant Pipe.—The inquiry for merchant pipe is still good as it has been for several months, and it is not thought the recent advance of $2 per ton will in any way check the new

business. Mills are filled to capacity for so long time ahead that the best deliveries are about 90 days. The contract for 275 miles of ten-inch 45-pound line pipe for the Burmah Oil Co., of India, has been placed through the United States Products Export Co., and will go to the National Tube Co. We quote the following official discounts for consumers' carloads, jobbers' discounts being 78 basing, base sizes, and 5:

	Steel		Iron	
	black	galv.	black	galv.
⅛ to ¼ inch	68	52	65.5	49.5
⅜ inch	70	56	65 5	49.5
½ inch	72	60	68.5	57.5
⅝ to 6 inches	76	66	73 5	63.5
7 to 12 inches	71	56	69	54
EXTRA STRONG PLAIN ENDS.				
⅛ to ⅜ inch	61	49	58.5	46.5
½ to 4 inches	68	56	65.5	53.5
4½ to 8 inches	64	52	61.5	48 5
Double extra strong plain ends, ⅛ to 8 inches	57	46	53.5	42.5

Boiler Tubes.—Specifications against existing contracts are very heavy and the new business is in good volume, locomotive boiler tubes being particularly active. We quote:

Boiler tubes.	Steel	Iron
1 to 1¼ inches	50	45
1¼ to 2¼ inches	62	45
2½ inches	64	50
2¾ to 5 inches	70	57
6 to 13 inches	62	45

Less than carloads two points less.
2½ inches and smaller, over 18 feet, 10 per cent. net, extra.
2¾ inches and larger, over 22 feet, 10 per cent. net, xtra.

Coke.—The inquiry for furnace coke for the first six months and the whole of next year is fair and one or two good contracts have been closed during the past week. While it cannot be verified, there is a rumor to the effect that the leading coke interest is already figuring on coke for 1908 delivery. There is very little coke for spot shipment and the supply of box cars for foundry coke is much below the requisitions, although there is a fair supply of open-top cars in the region. Standard Connellsville furnace coke for spot shipment is quoted $3.60 to $3.70, ovens, and for the first six months of next year $3.35 to $3.60. Contract furnace coke for the whole of next year is quoted $3.10 to $3.25. Connellsville standard 72-hour foundry coke on yearly contract is quoted $3.85 to $4, and for shipment through December and the first six months of next year $4 to $4.25. As noted last week, $4.25 to $4.50 has been paid for spot foundry coke.

Old Material.—The scrap market has quieted down a little as far as the demand is concerned, but prices are still advancing and there are no indications of weak points. Considerable scrap is coming out, yards being cleaned up and railroads wishing to dispose of their scrap before it is covered with snow. There has been some business done between dealers, but consumers are not inclined to pay the present prices. We quote: Heavy melting scrap, $19.50 to $20; rerolling rails, $21.50 to $22; bundled sheet scrap, $16.25 to $16.75; iron axles, $31.50 to $32; old iron rails, $25 to $26; No. 1 wrought scrap, $21 to $21.50; old car wheels, $22.50 to $23.50; low phosphorus scrap, $23 to $23.50; machine shop turnings, $15 to $15.50; axle turnings, $16.50 to $17; cast borings, $12.25 to $12.50; No. 1 east scrap, $19.50 to $20.

CHICAGO.

Very Active Market for Pre-Holiday Period.—Southern Pig Iron Higher.

Office of THE IRON TRADE REVIEW, 1362 MONADNOCK BLOCK, Dec. 11

The most interesting development in pig iron at the moment is the withdrawal from the market for the first half of 1907 of the Republic-Tennessee interests. Prices have strengthened as a result of this action and an advance to about the $19 Birmingham basis for the second quarter is momentarily expected. Advances in finished material continue to follow fast upon the heels of one another. Since the announcement of the changes in the wire, merchant pipe and cast pipe schedules a week ago, involving advances of $2 a ton each, new price lists have been issued for light rails and angle bars. The former was raised $1 a ton and the latter $3 a ton. Bar iron has also been strengthened by the congestion of specifications and orders for steel bars and local mills are now asking 1.80c Chicago for quick shipments. Sheets and boiler tubes are the next products rumor has slated for an advance. Car wheels have moved up another notch, and are now quoted at a minimum of $25 Chicago.

Specifications for structural shapes are light, and almost all producers are in position to give immediate shipment on almost any kind of an order. Plates, on the contrary, maintain an active condition, and while no "official" change has been made, 1.70c Pittsburg is asked by all producers.

Pig Iron.—The market shows a briskness unusual for this period of the year. Since the first of the month, inquiry has perceptibly broadened until it involves deliveries in every month of 1907. By far, the heaviest demand is for second and third quarters, with scattering lots for the first and last quarters of the year. Most of the inquiry for the last half is of a tentative nature and only about 25 per cent of it results in business.

The energies of the foundrymen today are mainly devoted to supplying their current wants; and since shipments from furnaces have not improved, the Macedonian cry for relief that has been heard for several weeks continues without any diminution in its insistency. The low prices for spot iron mentioned last week have been withdrawn, and $23 Birmingham for No. 2 foundry is now the minimum price quoted. There has also been a stiffening of prices for the first quarter, and $21 Birmingham is "rock bottom" for that shipment. For the third quarter or last half, current quotations of Birmingham furnaces range from $17 to $18. Northern producers are disinclined to quote for this delivery, and unless the buyer really means business it is difficult to learn just how low they will go for such requirement. But on the basis of southern quotations for the last half it is not believed that less than $22.50, Chicago, can be done on No. 2 foundry for spot shipment. Northern No. 2, or its equivalent, is offered at $26.50 to $27.50 Chicago. The largest transaction that has been closed here in several weeks was the sale of 15,000 tons to a car wheel manufacturer at a price around $22.50 Chicago. There is a greater supply of southern silveries than was available a few weeks ago, and prices for these are slightly easier in consequence.

The maximum prices in the following table of quotations are for first quarter shipments; the minimum prices for second quarter. The proposed advance of 25 cents a ton in Southern freight rates, effective Jan. 1 and Feb. 1, from the Virginia and Birmingham districts, respectively, is not included in these quotations, and will not be added until the advance formally goes into effect:

Lake Superior charcoal	$26.00 to 26 50
Northern Foundry No. 1	26.00 to 26.50
Northern Foundry No. 2	25.50 to 26.00
Northern Foundry No. 3	25.00 to 25.50
Northern Scotch Foundry	26.00 to 26.50
Ohio Strong Softeners No. 1	26 30
Ohio Strong Softeners No. 2	25 80
Southern Foundry No. 1	23.40 to 25.40
Southern Foundry No. 2	22 90 to 24.90
Southern Foundry No. 3	22 40 to 24 40
Southern Foundry No. 4	21.90 to 23 90
Southern No. 1 Soft	23 40 to 25.40
Southern No. 2 Soft	22 90 to 24.90
Southern Gray Forge	21.40 to 23.40
Southern Mottled	20 90 to 22.90
Southern Silveries (4 per cent to 6 per cent Silicon	27.40 to 29.90
Jackson Co. Silveries, 8 to 10 per cent Silicon	31 40 to 33.40
Malleable Bessemer	25 50 to 26.00

Billets.—There is an unending inquiry for forging billets. The bulk of the sales, however, are for forward shipments, for which $35 to $36 Chicago is obtained. Wire rods have increased in price and are now held at a minimum of $36 Pittsburg, or $39 Chicago for either open hearth or Bessemer.

Iron and Steel Bars.—With the approach of the end of the year, specifications for steel bars are falling off. New tonnage is also light. Rumors

are heard of a possible advance after the first of the year, but they are not taken seriously in authoritative quarters. Independent makers in position to make early shipments are asking on the basis of 1.80c Chicago for steel bars. Iron continues in active demand. The Illinois Central has placed the order for 7,000 tons, mentioned last week, dividing it among four western manufacturers. The local market is nominally on the basis of 1.60c Pittsburg, but $1 a ton higher is asked by some western interests on carload orders. We quote as follows:

Soft steel bars and bands, 1.76½c, half extras; soft steel angles, less than 3 x 3, 86½c; hoops, 2.16½c base. full extras; old rail stock, 1.70c. We quote bar iron from stock, 2.20c; full extras; soft steel rounds and squares, 3 inches and larger, $2 per 100 pounds base; flats, 2 inches to 4 inches by 1⅛ inch and larger, $2 per 100 pounds base; 4½ inches x 5 inches and 6 inches x 5-16 inch and thicker, $2 per 100 pounds base; all ovals, half rounds, $2 per 100 pounds base; steel bands, $2.00 half extras; soft steel hoops, 2.40c to 2.50c full extras. Other sizes not mentioned above, $2 per 100 pounds base plus half extras.

Sheets.—New tonnage and specifications for black and galvanized sheets show no diminution. All the western makers are crowded with specifications, and premiums are offered for early delivery. The market is very firm. Jobbers are feeling the pressure of orders for promt shipment and are experiencing no little difficulty in replenishing their rapidly depleted stocks. We quote as follows:

Black sheets, Nos. 8, 9 and 10, 1.85c Pittsburg; No. 28 gauge, 2.60c Pittsburg. Galvanized sheets No. 28 gauge 3.65c Pittsburg. Freight to Chicago 16½c per 100 pounds. Jobbers' prices on less than carload lots from store are as follows: Black sheets, No. 10, 2.20c to 2.30c; No. 12, 2.25c to 2.35c; No. 14, 2.30c to 2.40c; No. 16, 2.40c to 2.50c; Nos. 18-20, 2.70c to 2.80c; Nos. 22-24, 2.75c to 2.85c; No. 26, 2.80c to 2.90c; No. 27 2.85c to 2.95c; No. 28, 2.95c to 3.05c; No. 30, 3.35c. Galvanized sheets, Nos. 10 to 20, 3.25c to 3.35c; Nos. 22 and 24, 3.40c to 3.45c; No. 26, 3.60c to 3.70c; No. 27, 3.80c to 3.90c; No. 28, 4c to 4.10c; No. 30, 5.20c to 5.30c.

Plates.—The local market is squarely on the basis of 1.70c Pittsburg, all current business being taken at this figure. Tonnage is active, especially for early shipment. Forward requirements are receiving attention, several contracts having been placed providing for deliveries running through the entire year. Independent makers and jobbers are benefiting most by the present condition, most of these being able to make early shipment. We quote as follows:

Tank steel, ¼-inch and heavier, up to 100 inches wide, 1.60c Pittsburg base. For extras see Pittsburg report. Freight rate to Chicago is 16½c per hundred pounds.

Jobbers' prices for shipment from local stocks are as follows: Tank steel ¼ inch and heavier, up to 72 inches wide, 2.10c; 72 inches up to 96 inches wide, 2.20c; 3-10 inch up to and including 60 inches wide, 2.20c; 3-16 inch, 72 inches wide, 2.45c; No. 8, up to 60 inches wide, 2.25c; flange steel, 25c extra; heads, 25c extra.

Structural Steel.—Specifications for shapes show a decided falling off. All the western makers are running light on beams, channels and angles, and can give immediate shipment on almost any kind of an order. The only important contract involving structural steel that has been closed in the week under review was for 2,000 steel cars for the Wabash railway which was placed with the Cambria Steel Co. Mill prices are without change, as follows:

Beams and channels, 3 to 15 inches inclusive, 1.70c Pittsburg. For extras see Pittsburg report. Freight rate from that city to Chicago is 16½c per 100 pounds. Quotations from store are as follows:

All angles, three inches and larger, including six inches, $2.05 to $2.10 per 100 pounds; angles over six inches, $2.15 per 100 pounds base; beams, three inches to 15 inches, inclusive $2.05 to $2.10 per 100 pounds base; channels, three inches and larger, $2.05 per 100 pounds base. Less than carload lots are $2 a ton higher than foregoing prices.

Rails and Track Supplies.—An advance of $1 a ton in light rails went into effect yesterday. Angle bars have also been advanced $3 a ton. There is a good demand for both these products, but little is doing in standard sections. We have revised our prices and quote as follows:

Bessemer rails, $28; open-hearth $29; light rails, Bessemer, 30 to 45-pound sections, $33; 25-pound, $34; 20-pound, $35; 16-pound, $36; 12-pound, $37, and lighter sections down to 8-pound, $43.50, all f. o. b. mill. Track supplies vary in price according to quantity and delivery. Angle bars in large lots are quoted 1.65c to 1.75c; for smaller quantities, 2.25c to 2.75c; spikes, large lots, 2.25c; for smaller quantities, 2.50c; bolts, large lots, 2.65c to 2.75c; smaller lots, 2.85c with square nuts, and 3c with hexagon nuts.

Merchant Steel.—The inventory period, which comes at the end of the year with most implement manufacturers, has caused some falling off in specifications. Otherwise, the situation is without any appreciable change. All prices are firmly maintained. We quote as follows:

Planished or smooth finished tire steel, 1.96½c; iron finish, up to 1½ x ½ inch, 1.91½c; iron finish, 1½ x ½ inch and larger, 1.76½c, base; channels for solid rubber tires, ¾ to 1 inch, 2.26½c, and 1⅛ inch and larger, 2.16½c; smooth finished machinery steel, 2.01½c; flat sleigh shoe, 1.81½c; concave and convex sleigh shoe 2.06½c; cutter shoe, 2.35c; toe calk steel, 2.31½c; railway spring, 1.96½c; crucible tool steel, 6½c to 8c, with higher prices asked on special grades. Shafting is very strong and an advance is expected. Quotations are without change at 50 per cent off in car lots and 45 per cent in less than car lots, in base territory.

Merchant Pipes.—The advance of $2 a ton which was announced last week has not caused any falling off in tonnage. New business and specifications are coming in as freely as before; in fact both are heavier than is usually experienced at this time of the year. We have revised our prices, and quote as follows: ¾ to six inch black steel pipe, 76.35; galvanzied, 66.35. From store in small lots, Chicago discounts are 73½ to 74½ per cent discount on the base size.

Cast Iron Pipe.—The higher prices announced a week ago has caused the postponement of a number of pending transactions. No inquiries of importance have come up in the week under review. We quote carload lots, Chicago delivery, as follows: 4-inch water pipe, $37 to $38; 6, 8, 10 and 12-inch, $36 to $37; gas pipe, $1 a ton higher.

Boiler Tubes.—Jobbers continue to specify freely on their contracts with makers, indicating an active distribution in the consuming lines. No change has yet been made in prices, but an advance is looked for at an early date. Prices are without change as follows: 2¾ to five iches, steel, 68.35; iron, 55.35; seamless, 2¾ to 4½, 50.85. Less than carload lots from store, base sizes, are 60 off for steel; 47½ for iron, and 42½ for seamless tubes.

Wire Products.—New tonnage continues in undiminished volume. One large maker avers that if the present

daily average is maintained through the balance of the month, December will be the heaviest in the history of the company in point of tonnage. The advance of $2 a ton announced last week has increased the volume of business rather than otherwise. We have revised our prices, and quote to jobbers, Chicago delivery, as follows: Wire nails, $2.15; painted barbed wire, $2.30; galvanized barbed wire, $2.60; smooth annealed wire, $2.30; polished staples, $2.30; galvanized staples, $2.55. Carload lots to retailers, five cents higher; less than carload lots, 15 cents higher.

Coke.—Early shipments of coke are hard to obtain in the local market. West Virginia shipments have fallen off as a result of the southern car shortage, while the congestion of orders at Connellsville ovens has created a local scarcity in the product of that district. Foundry coke is firm at at a minimum of $4 ovens, while for prompt shipment, $4.25 to $4.50 is easily obtained.

Old Material.—Car wheels have advanced another 50 cents a ton, and are now quoted at $25 to $25.50 Chicago. Old material is not moving very freely, the ideas of sellers and dealers on the matter of prices being very far apart. As long as the open weather that now prevails continues, no marked strengthening of the situation is expected. We quote as follows, gross tons being given in the first paragraph:

Old Steel Rails (4 feet and over)	$20.50 to 21.00
Old Steel Rails (less than 4 feet)	19.50 to 20.00
Old Car Wheels	25.00 to 25.50
Old Iron Rails	28.00 to 28.50
Relaying Rails, subject to inspection	29.00 to 30.00
Frogs, Switches and Guards	18.50 to 19.00
Heavy Melting Steel	17.50 to 18.00
Mixed Country Steel	15.00 to 15.50

We quote net tons, as follows:

No. 1 R. R. Wrought	$18.00 to 18.50
No. 2 R. R. Wrought	17.00 to 17.50
Shafting	19.00 to 19.50
Dealers' Forge No. 1	13.50 to 14.00
Wrought Pipe and Flues	13.00 to 13.50
No. 1 Cast, 150 pounds and less	17.50 to 18.00
No. 1 Mill	10.50 to 11.00
Mixed Busheling (No. 1 & No. 2)	13.00 to 13.50
Country Sheet	9.00 to 9.50
No. 1 Boilers Cut	12.50 to 13.00
Boiler Punchings	16.00 to 16.50
Iron Car Axles	26.50 to 27.00
Steel Car Axles	23.00 to 23.50
Iron Axle Turnings	11.00 to 11.50
Cast Borings	9.00 to 9.50
Mixed Borings, etc	9.00 to 9.50
Machine Shop Turnings	11.00 to 11.50
Railroad Malleable	18.00 to 18.50
Agricultural Malleable	17.00 to 17.50
Stove Plate and Light Cast Scrap	14.00 to 14.50
Old Iron Splice Bars	22.00 to 22.50

CLEVELAND.

All Finished Lines Except Shapes Active.—Small December Shipments of Ore.

Office of THE IRON TRADE REVIEW, Browning Building, Dec. 12.

Iron Ore.—Extremely cold weather at Lake Superior ports has put a sudden end to the ore movement for the season. In some instances boats were obliged to leave for southern points without cargoes after waiting from ten days to two weeks. The shipments for December, consequently, have been extremely small, falling considerably short of the movement during December, 1905. The total for the season will be in the neighborhood of 37,250,000 tons. To Dec. 1, the total movement was 36,973,002 tons, an increase of 3,901,158 tons, or 11.8 per cent, over 1905. By ports the shipments for November and for the season to Dec. 1 were as follows:

	Nov. 1905.	Per Cent. of total.	Nov. 1906.	Per Cent. of total.
Escanaba	630,463	18.87	748,912	20.06
Marquette	294,040	8.80	233,933	6.27
Ashland	426,346	12.76	284,507	7.61
Superior	468,827	14.03	626,633	16.78
Duluth	871,730	26.09	1,142,959	30.61
Two Harbors	649,823	19.45	697,223	18.67
	3,341,229	100.00	3,734,167	100.00

	To Dec. 1, 1905.	Per Ct. of total.	To Dec. 1, 1906.	Per Ct. of total.
Escanaba	5,186,385	15.65	5,716,272	15.46
Marquette	2,925,250	8.84	2,743,219	7.42
Ashland	3,460,120	10.47	3,333,561	9.02
Superior	5,043,234	15.25	5,979,378	16.17
Duluth	8,767,706	26.51	11,098,175	30.02
Two Harbors	7,699,149	23.28	8,102,397	21.91
	33,071,844	100.00	36,973,002	100.00

Chartering has continued during the week at the rates holding during the present season and independent interests are fairly well covered. Only an occasional lot of inferior ore is now offered for sale. Based on the reduced iron content recently established, prices for next season are quoted as follows: Old Range Bessemer, $5.00; Mesabi Bessemer, $4.75; Old Range non-Bessemer, $4.20; Mesabi non-Bessemer, $4.00.

Pig Iron.—Interest in the pig iron market centers in deliveries, in which no improvement is noted. Within a month two new merchant stacks will begin making iron in this district, one at Toledo and the other at Josephine, Pa., while a Buffalo stack has just gone out of blast for relining and others, weakened by their long run, are preparing for such an emergency. Prices have stiffened somewhat and spot iron now sells on the basis of $26, Cleveland; for No. 2 foundry for second quarter delivery $23 is asked and for the last half $21.50 to $22.00. One important southern interest has withdrawn from the market for the first half, and another, it is stated, will shortly enter the market offering its last half iron on the basis of $19 Birmingham, which will equal $23.35, Cleveland, when the advanced freight rates become operative. Inquiries for basic iron are numerous, but producers are not yet willing to sell later than the middle of the year: a recent sale for January delivery was made at $24 valley. The beginning of the new year will witness the closing of numerous contracts for foundry products, which will, of course, be on a much higher basis than heretofore, owing to the remarkable advance of iron. Little difficulty is anticipated by foundrymen in securing higher prices, however, as the demand for castings is phenomenal. The foundrymen's greatest difficulties at present are in connection with his iron supply, and an instance is noted this week in the Cleveland district of one fairly large foundry being forced to close because of inability to secure iron. We quote second quarter delivery, f. o. b. Cleveland, as follows:

Bessemer	$21.85 to 22.85
No. 1 Foundry	22.50 to 23.50
No. 2 Foundry	22.00 to 23.00
No. 3 Foundry	21.60 to 22.00
No. 2 Southern	22.00 to 22.50
Gray Forge	21.00 to 21.00
Gray Forge, Southern	18.00 to 18.50
Lake Superior charcoal	25.00 to 26.00

Coke.—Foundry coke is selling at $4.00 to $4.25 ovens, with furnace coke exhibiting a wider range, quotations being from $3.25 to $3.65, with limited supply. The car situation is unimproved.

Finished Materials. — Improved strength is manifested in almost every line of finished materials, structural shapes alone being comparatively easy, though in better demand than previously and with specifications good. The plate business even at the advanced price has been so heavy that one large interest has practically withdrawn from the market. Independent mills, which heretofore have been making fairly prompt deliveries, are filling up with orders and shipments are further delayed. There is continued talk of an advance in sheets, deliveries on which are constantly becoming slower. In steel bars new business is receiving little attention, all efforts being directed toward filling specifications. Iron bars are extremely active, and large car building concerns are now negotiating for several thousand tons each. In railway supplies an important interest announces several advances. Light rails in carload lots are now selling on the basis of $33 Pittsburg for 20 to 45 pounds, $33.50 for 16 pounds and $36 for 12 pounds, $5 being added in case purchases are for less than carload lots. Splice bars have advanced $2 a ton to 1.60c, Pittsburg, and at that are sold only in connection with good-sized tonnages of rails. Plates and nuts have advanced from 2.50c to 2.60c Pittsburg. Standard car axles have been advanced $2.00 a ton to 2.30c, Pittsburg, for freight and 2.40c,

Pittsburg, for passenger, these prices holding only for large lots.

Old Materials.—The market continues strong with consumers inquiring for machinery cast and other important lines. Low phosphorus scrap has advanced rapidly of late, and higher prices are quoted for heavy steel, axle turnings and grate bars. We quote Cleveland delivery, gross tons in first paragraph, as follows:

Old iron rails	$27.00 to 27.50
Old steel rails (over 6 feet)	20.00 to 20.50
Old steel rails (under 6 feet)	19.00 to 20.00
Old car wheels	21.00 to 21.50
Steel boiler plate	16.00 to 16.50
Steel axles	22.00 to 23.00
Malleable iron (railroad)	19.50 to 20.00
Malleable iron (agricultural)	15.50 to 16.00
Heavy steel	18.25 to 18.75
Country mixed steel	15.50 to 16.00
Low phosperous	24.00 to 25.00

We quote net tons as follows:

No. 1 R. R. wrought	$19.00 to 19.50
No. 1 busheling	15.50 to 16.00
No. 1 machine cast	19.50 to 20.00
Iron axles	26.00 to 27.00
Axle turnings	14.00 to 14.50
Wrought turnings (free from cast)	12.00 to 12.50
Grate bars	15.00 to 15.50
Pipes and flues	15.00 to 15.50
Tank iron	12.50 to 13.00
Hoop and band iron	9.00 to 9.50
Sheet iron	9.00 to 9.50
Wrought drillings	12.00 to 12.50
Stove plate	14.50 to 15.00
Cast borings	9.50 to 10.00

CINCINNATI.

Pig Iron Market Firmer.—Spot Iron Supply Adequate at High Prices.

December 11.

Pig Iron.—While there has been no material change in the market the past week, so far as prices are concerned, there is noticeable a slightly firmer tone. The volume of business has been fair and there is more interest shown by buyers in iron for delivery in the last half of the year. Spot iron is in fair demand with a supply available fully equal to the wants at the prices now prevailing. It is hinted that some spot iron has sold slightly below current prices during the week. Large consumers continue to take any round lots that may come out and thus the market is relieved of a depressing supply, but the scarcity of cars and the delays on the part of furnaces in filling contracts keep enough inquiry for quick shipment iron in the market to sustain prices. We quote for December delivery or prompt shipment as a basis for settling contracts made on our quotations the following prices f. o. b. Cincinnati:

Southern foundry No. 1,	$25.50 to $26.50
Southern foundry No. 2,	25.00 to 26.00
Southern foundry No. 3,	24.50 to 25.50
Southern foundry No. 4,	24.00 to 25.00
Southern fdry. No. 1 soft	25.50 to 26.50
Southern fdry. No. 2 soft	25.00 to 26.00
Gray forge	22.00 to 23.00
Northern foundry No. 1,	25.65 to 26.65
Northern foundry No. 2,	25.15 to 26.15
Northern foundry No. 3,	24.65 to 25.65
Jackson County silvery, 8 per cent	29.15 to 30.15

First quarter iron is selling mostly on a separate basis for each month. January delivery brings a premium over February and March. The range of prices for delivery in the first quarter is $20.00 to $22.00 Birmingham. There is not much southern iron offered for this period and buyers are fairly well covered.

Second quarter delivery iron is firmer and while $18.50 Birmingham is still being done, the market appears to be nearer $19.00. For the last half of the year southern iron is quoted at $17.50 Birmingham and northern at $21.00 furnace. Considerable last half iron has been sold quietly recently, but as a rule it has gone to melters who have sold castings and covered their casting contracts with pig iron purchases. We quote for second quarter delivery f. o. b. Cincinnati, as follows:

Southern Foundry No. 1	$22.00 to 22.50
Southern Foundry No. 2	21.50 to 22.00
Southern Foundry No. 3	21.00 to 21.50
Southern Foundry No. 4	20.50 to 21.00
Southern Foundry No. 1, soft	22.00 to 22.50
Southern Foundry No. 2, soft	21.50 to 22.00

Coke.—The difficulty in getting coke forward on contracts is still the chief feature in the market. Prices remain strong. There is some contracting for first half of next year, but as a rule the inquiry is for spot coke to keep running on owing to failure to get contract supplies. Prices in the leading coke producing districts are as follows:

Gray Forge	19.50 to 20.00
Northern Foundry No. 1	22.65 to 23.15
Northern Foundry No. 2	22.15 to 22.65
Northern Foundry No. 3	21.65 to 22.15
Jackson County Silvery, 8 per cent	28.15 to 29.15
Wise County, Va. Furnace Coke prompt shipment	$3.50 to 3.75 per ton
Wise County, Va. Foundry Coke	4.00 to 4.50 per ton
Pocahontas Furnace Coke prompt shipment	3.25 to 3.50 per ton
Pocahontas Foundry Coke	3.50 to 4.00 per ton
Connellsville Furnace Coke prompt shipment	3.15 to 3.50 per ton
Connellsville Foundry Coke	4.15 to 4.50 per ton
New River Foundry Coke on contracts	3.50 to 4.00 per ton
New River Furnace Coke, prompt shipment	2.75 to 3.00 per ton

†Wise County, Va., Coke on Furnace contracts is sold mainly on a sliding scale basis for pig iron prices on the following basis: $1.70 to $1.75 per ton on $9.00 pig iron, plus 19 to 20 per cent of the advance on pig iron above $9.00 Birmingham.

Finished Material.—The market in a jobbing way is active and the stores are busy filling orders from stock. Mill deliveries are so uncertain that material from structural yards and store is in constant demand. Retail prices from store here are as follows:

Angles 3 x 3 and over, 2.15c to 2.25c; beams and channels 15 inches and under, 2.15c; small angles and architectural channels, 2.10c base; plates ¼ inch and heavier, 2c; 3-16 inch, 2.10c; No. 8, 2.10c; sheets (blue annealed) No. 10, 2.15c; No. 12, 2.20c; No. 14, 2.25c; No. 16, 2.35c; box annealed sheets Nos. 18 and 20, 2.50c; Nos. 22 and 24, 2.60c; Nos. 25 and 26, 2.65c; No. 27, 2.70c, and No. 28, 2.80c. Iron and steel bars, 1.95c base; boiler tubes, 67 per cent off base; turn buckle 45 per cent off; rivets, 3.15c base; cold rolled shafting 45 per cent off list; steel tire, 2.10c base.

Old Material.—The market continues strong with melters buying freely and melting scrap in the place of pig iron in many instances. We note changes in quotations for wrought turnings and old car wheels. Dealers prices to consumers f. o. b. Cincinnati, are as follows:

Old No. 1 railroad wrought, net tons	$18.50 to 19.00
Cast machine and foundry, net tons	18.50 to 19.00
Old iron rails, gross tons	26.00 to 27.00
Old steel rails, gross tons	19.00 to 20.00
Old short lengths, gross tons	19.00 to 20.00
Old iron axles, net tons	26.00 to 27.00
Heavy melting scrap, gross ton	20.00 to 21.00
Stove plate, net tons	14.00 to 14.50
Wrought turnings, net tons	12.50 to 13.00
Cast borings, net tons	9.00 to 9.50
Car wheels, gross tons	21.50 to 22.00

PHILADELPHIA.

Chaotic Conditions with Little Iron For Prompt Shipment.

December 11.

Pig Iron.—The market may still be described as decidedly chaotic, prices defying exact quotation and depending very largely on the circumstances of each sale. One large producer, for instance, announces that practically all distinction has been wiped out in prices for spot shipments and first and second quarters, and that third quarter orders are being taken at a reduction of from $1 to $2 a ton from the other figures. Another refuses to sell any second quarter iron unless orders are placed at the same time for the third quarter at substantially the same price. Still another is demanding $25.75 for No. 2 X foundry for the second half and is getting it. In all this diversity it is very apparent that there is practically no iron for prompt shipment, and that if the winter proves very severe, with serious interruptions to transportation, many consumers will have to close their establishments for lack of supplies. The amount of English and Scotch iron bought for American consumption is now estimated at 200,000 tons, of which perhaps 40,000 tons have already arrived. One drawback to this source of supply may be noted in the fact that a steamship with a cargo of 5,000 tons, all of which has been sold, is now two weeks overdue and much anxiety is felt as to her fate. Solid cargoes of pig iron do not make the most desirable loading for a vessel crossing the Atlantic in winter gales. Severe January weather on the ocean may thus have its effect on market conditions equally with heavy snow storms on the land. No. 1 Middlesboro is now quoted at $23.50 at the dock. No. 3 at $22.50 and Scotch at $24.50. Prices for domestic iron show little change from last week and may be quoted as follows:

No. 1X Foundry	$26.00 to 26.75
No. 2X Foundry	24.75 to 25.75
No. 2 Plain	24.25 to 24.75
Standard Gray Forge	22.00 to 22.75
Basic	22.75 to 23.25
Low Phosphorus	27.00 to 28.00

New Material.—Despite the recent advances in prices new business continues very large in all branches, especially in structural material and iron and steel bars. Complaint is heard from some mills as to the difficulty in securing pig iron, and this factor is likely to count even more strongly in the future on prices. Prices continue as quoted last week: Beams, channels and angles according to specifications, 1.83½c to 2c; refined iron bars, 1.83½c to 1.93½c; steel bars, 1.78½c to 1.83½c; plates, 1.93½c to 1.98½c.

Old Material.—Active buying by the mills, shortage in cars and the usual falling off in the collection of scrap as winter closes in are all combining to force prices up, and the movement is helped along by the high prices now demanded for pig iron. The result is an advance in a number of lines, and still higher prices are confidently predicted. Quotations for the present may be given as follows:

Old steel rails	$20.00 to 20.50
No. 1 steel scrap	19.75 to 20.25
Old steel axles	22.75 to 23.50
Old iron axles	31.00 to 32.00
Old iron rails	27.00 to 28.00
Old car wheels	21.50 to 22.00
Choice scrap, R. R. No. 1 wrought	23.00 to 23.50
No. 1 yard scrap	20.00 to 20.50
Machinery scrap	20.50 to 21.00
Low phosphorus scrap	23.50 to 24.00
Wrought iron pipe	17.25 to 17.75
No. 1 forge fire scrap	17.00 to 17.50
No. 2 forge fire scrap, ordinary	12.50 to 13.00
Wrought turnings	16.00 to 16.50
Axle turnings, heavy	16.75 to 17.25
Cast borings	13.00 to 13.50
Stove plates	16.25 to 16.75

NEW YORK.

Undiminished Strength in Pig Iron Market.—Much Irregularity in All Kinds of Scrap.

Office of THE IRON TRADE REVIEW. }
ROOM 1315, No. 150 NASSAU ST., Dec 10 }

Pig Iron.—The chief feature of the week has been a very fair amount of buying for forward delivery. There were numerous sales of comparatively small lots and several of 5,000 tons each. Buying of small quantities of foundry iron for early delivery goes on steadily, both foreign and odd lots of domestic metal being used to fill in gaps. Prices remain firm, the demand being apparently of undiminished volume. Few of the foundries are in urgent need of supplies, but all are more or less anxious about the shipments contracted for and dislike to permit their stocks to run low. Shipments on old contracts have improved materially, especially from furnaces in the south. On the other hand odd lots of spot iron are constantly making their appearance in the north, which tends to relieve the situation.

There is a steady current of foreign metal into consuming channels, mostly in small lots, and it is still possible to secure Middlesboro pig at prices considerably below those of the same grades of domestic iron. Prices abroad are, however, rising and it is difficult to find Scotch for early shipment. Today's quotations on cargo lots of Scotch are 80 and 81 shillings delivered in New York in February and March. London quotations for standard and Cleveland warrants are 62 shillings, 3 pence and 63 shillings respectively. Another cargo of 5,000 or 6,000 tons for shipment to this port has been arranged for.

Sales of domestic foundry grades for second and third quarter amount to many thousand tons. One firm disposed of 7,000 tons of southern No. 2 at $19, furnace. Transactions involving the same grade of northern iron were conducted on a basis of about $23. For spot lots prices still depend upon the buyers' willingness to pay, but a common figure is $27 delivered in New England and the Hudson river valley. A lot of 100 tons 2 X eastern Pennsylvania brought $26 at the furnace and another was offered at $25.25.

In basic there has been little or no business during the week, but a comparatively large tonnage is now pending. Some of the steel makers near the coast are running on the from hand to mouth plan, and it seems that no foreign basic is to be had. There has been some business in malleable and Bessemer and it is reported that a large block of hematite has been purchased abroad for importation.

Several thousand tons of gray forge were sold at the relatively high prices reported last week, including one of 2,500 tons. Very little of this total was designed for mill purposes, the greater portion being destined for the foundry cupola. Prices ranged from $22.50 to $23.50, one particular lot bringing $23.20 delivered.

The demand for ferro-manganese is fairly active and prices rule slightly higher, from $82 to $87 according to quantity and delivery.

The following are prices from pig iron at tidewater for forward delivery:

Northern Foundry No. 1	$25.00 to 26.00
No. 2 Foundry	24.50 to 25.50
No. 2 Plain	24.00 to 25.00
No. 1 Southern Foundry	23.50 to 25.00
No. 2 Southern Foundry	23.00 to 24.50
No. 3 Southern Foundry	21.50 to 22.50
No. 4 Foundry	21.00 to 22.00

Finished Iron and Steel. — The greatest interest is still being centered in the lighter finished products. Inquiries for plates, largely for ship building purposes, have been in large volume and there is now a marked difference in price, one firm which is doing business on a basis of $1.80, Pittsburg, having had occasion during the week to refuse orders aggregating 20,000 tons.

In the structural field there have been some goodly orders and there are others in prospect. The American Bridge Co.'s complete list of November bookings shows 50,000 tons and not 40,000 tons as previously reported. This is not much below the capacity of the mills and merely offset some of the excessively heavy months. The present month promises to be fully up to the average in spite of the disadvantage of between seasons. Among the orders added to the company's total during the week were the following for railroad bridge work: Lehigh and Hudson, 1,000 tons; Virginia & Southwestern, 700; Chicago, Milwaukee & St. Paul, 600 tons, and 300 tons for another road. Other contracts were: 7,500 tons for the South & West railroad which went partly to the Pennsylvania Steel Co. and partly to the King Bridge Co., 900 tons for the Lehigh Valley; 200 tons for the Pennsylvania railroad, and 300 tons for bridge work on the New Haven & Hartford. A contract for about 8,000 tons of steel to be used in the construction of approaches to the Blackwell island bridge will soon be let.

Actual new business in steel rails has been confined to comparatively small purchases by trolley and electric roads. Several larger contracts are still pending and other sales may be found elsewhere in the present issue.

Old Materials.—The market shows great activity and prices are strong all along the line. Great irregularity prevails, each sale being governed by its own conditions. Eastern Pennsylvania, usually the most active buyer, is somewhat less eager than other sections of the country. Pittsburg is especially active. Sales of 3,000 tons of heavy melting steel in shape for charging at $20.50 and $20 delivered are reported. Cast scrap is exceedingly scarce in this section, carload lots being reported sold at $19 gross ton f. o. b. for New York for ordinary yard selection and $21 for strictly machinery. The following are prices approximately f. o. b. tidewater:

Old iron rails	$25.00 to 25.50
Old steel rails, long lengths	17.50 to 18.50
Old steel rails, short pieces	16.50 to 17.50
Relaying rails	27.00 to 28.00
Old car wheels	21.00 to 23.00
Old iron car axles	29.00 to 30.00
Old steel car axles	21.00 to 21.50
Heavy melting steel scrap	18.00 to 18.50
No. 1 railroad wrought scrap	20.00 to 20.50
Iron track scrap	18.00 to 19.00
Wrought pipe	14.50 to 15.00
Cast borings	11.00 to 11.50
Wrought turnings	15.25 to 15.75
Heavy Cast Scrap	19.00 to 21.00

BUFFALO.

Iron for Delivery Before the Last Half Difficult to Obtain.

December 11.

Pig Iron.—Prices are holding firm, and nearly all the business done the past week was for the last half, some being placed for the last quarter of 1907. An indication of the strong demand for pig iron was shown in many instances by urgent requests of buyers for delivery sometime during the first half, it being stated that orders on their books made it necessary for them to secure iron before the last half. In spite of the urgency of these requests, however, firms having iron to place for last half delivery had to refuse, as they cannot see their way clear to fill orders for anything but last half business. The larger firms say inquiries for earlier delivery are made daily, but they are of no avail. In several cases dealers have been tempted with fancy prices if they could find a way of making an early delivery of portions of last half orders.

Scattering lots of southern iron are being placed in this district. This is unusual for Buffalo, and prices, of course, are soaring. Sales made this week are reported at $25 and $26 Birmingham, the freight to Buffalo territory being $4.65 a ton. High and low silicon southern is in demand at high prices. Foreign iron still finds Buffalo a good market and the center of buying seems to be in foreign iron now that so little can be placed for first half delivery. Sales of foreign have been for spot delivery. Scotch iron sold this week for $27 delivered here, and Middleborough No. 1 at $26, and No. 3 at $25, delivered. The freight on foreign iron into this territory is $2.50 and it is understood that this rate will be advanced a few cents a ton after the first of the year.

Foundries are calling for more than their usual amount of pig iron and seem to be doing an excellent business, an increased output being observed of late at nearly all local foundries. There have been slight variations in prices this week, but the general tone is about the same. We quote for last half of 1907 as follows:

No. 2 Plain Foundry	$21.00 to 22.00
No. 2 X Foundry	21.50 to 22.00
No. 3 Foundry	21.00 to 21.50
Malleable Bessemer	22.00 to 22.50
Gray Forge	20.50 to 21.00
Charcoal	24.00 to 25.00

BIRMINGHAM.

Four Furnaces Blown Out and Others May Close Down Soon.

December 11.

There is no relief in sight in Alabama as far as transportation facilities are concerned. Almost all of the iron manufacturers in this district are behind from two to seven weeks on their deliveries. One of the larger railroad systems in the south is dividing its divisions in the industrial sections with the belief that some relief can be given to the situation.

On the top of the car shortage and inability to deliver iron sold some weeks and even months since, announcement is made that four furnaces have been blown out for repairs and that if there is no relief in the way of handling raw material supplies to the furnaces other iron-makers will either have to go out of blast or run slack. The shutting down of four furnaces will seriously affect the output for the last month of the year. Intimation is given that less iron will be produced in Alabama in December than during any month this year. The Southern Steel Co. has blown out the furnace recently purchased, located at Rising Fawn, Ga., the Sheffield Iron Co. has blown out one furnace, and the Tennessee Coal, Iron & Railroad Co. has blown out two furnaces in the Birmingham district. The raw material supplies are very unsteady, fuel and coke being especially so.

All advantage of the good weather is being taken in the excavation work for the foundations for the big steel plant being erected by the Tennessee company adjacent to the steel plant at Ensley, and it may be ready for operation by the first of September or October.

ST. LOUIS.

No Relief for the New Year in Sight. —Foundries Compelled to Close.

December 11.

It is now apparent that the market will run into next year under the same stringent conditions which have prevailed for the last two months. While the market has not been very active, a fair run of small orders has been booked and prices for the first quarter continue to creep up. On account of the delay in deliveries, the spot market is the important one today. Any agent who is fortunate enough to have a car on track can get almost whatever he asks. No. 2 southern sold as high as $24, but spot shipment usually can be had for $23 to $23.50. At this figure some of the small melters who made contracts when iron was selling at $13 and $14 cannot operate without loss, and several of them are shutting down until they can get cheaper iron. Some of them are covered, but they are unable to get deliveries. No. 2 southern is quoted at $22 for first quarter. Second quarter is quoted at $19.50 and the third at $18, though there is no regular market figure for the latter period. Some little iron for third quarter has been sold, but inquiries in the main for that delivery are to sound the market. One southern furnace turned down an order for 1,000 tons of No. 2 soft at $18 for second and third quarters.

Quotations for the first quarter for St. Louis delivery range as follows:

Southern No. 1	$25.50 to 26.00
Southern No. 2	25.00 to 25.50
Southern No. 3	24.50 to 25.00
Southern No. 4	24.00 to 24.50
Gray Forge	23.50 to 24.00

Coke is firm and the supply from standard ovens is less than the demand.

Finished Materials.—The contract for the steel for the Third National Bank building was let to the Brown-Ketchem Co. of Indianapolis. About 2,100 to 2,200 tons will be required. New projects of active interest are the new twelve-story Girard apartment house and the new Tate theatre at Eighth and St. Charles The work of demolishing the old building for the theatre has begun.

Metal Market

NEW YORK.

December 11.

Pig Tin.—After violent fluctuations during the week due to alternate heavy buying and pressure to sell the market closed quiet and easy.

The following are today's quotations. Spot, 42.70 to 43.05; December, 42.50 to 43.00; January, 42.45 to 42.90; London, £196 10s and £195 15s. Arrivals for the month to date, 1,340. Afloat, 3,150 tons.

Copper.—Exporters have been steadily in the market for any surplus and the market rules firm.—Today's quotations: Lake, 22¾ to 23; electrolytic, 22¼ to 22½; casting, 22⅛ to 22⅜; Lonon, £104 2s 6d and £105 2s 6d. Exports for the month to date, 2,291.

Lead.—The demand has been active and the market is firm. Today's quotations, 5.95c to 6.05c; St. Louis, 5.87½c; London, £19 3s 9d.

Spelter.—Refined spelter has been in good demand and strong. Today's quotations: 6.52½ to 6.57½; St. Louis, 6.45; London, £27 15s.

ST. LOUIS.

December 11.

Lead is quiet but firm at $5.87½ for common, and $5.95 for corroding Missouri.

Spelter took another sharp advance, and today $6.50 was bid with no sellers.

THE IRON TRADE REVIEW

Devoted to Iron and Steel Manufacture and to the Machinery, Metal-Working and Foundry Trades.

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THE RAILROADS AND THE PEOPLE.

For the purpose of influencing the action of congress, and possibly for other reasons not disclosed, an effort is being made on the part of some railroads and their organs to show that the attitude of the American people toward the railroads is very unjust, and that unless it is changed, they will find it necessary to adopt a policy of rigid economy in expenditures, especially in the purchase of new equipment. The *Financial Chronicle* of New York, recently quoted from an address delivered at Montgomery, Ala., by Mr. Samuel Spencer, president of the Southern railway, whose death last week is universally deplored, in which he stated that instead of $9.00 per thousand feet for bridge and shop lumber paid in 1890, the cost is now $16.00 to $20.00; the price of steel rails has advanced from $18.00 to $28.00 or $29.00; instead of $11,000 each for locomotives, the cost is now from $16,000 to $20,000 or more; instead of $475 for box cars, the cost is now $800, and so on through the long list of necessary railroad purchases. Mr. Spencer said that the percentage contributed by transportation rates to the cost of whatever the people consume, is much smaller than ever before in history, and smaller in America than any other country in the world. "And yet," adds the *Chronicle*, "the loudest cry that is heard today from the public voice, and the most persistent demand from every quarter, is for an enforced reduction in railway charges."

In spite of the undeniable increase of the cost of railway supplies, the earnings of the railroads have advanced as never before in the history of the country. In the very issue in which the *Chronicle* editorial referred to was published, we find it stated that "the gross earnings of the United States railroads continue their wonderful record of improvement. Our compilation this time covers the roads which have furnished early returns for the month of October, comprising altogether 92,760 miles of road. For this mileage, the increase as compared with the same month last year reaches $8,788,150, (11.26 per cent), foreshadowing a striking amount of gain when we shall have the results complete for all the roads in the country, comprising over 200,000 miles." For nine months of the current year, 114 roads show an increase of net earnings of 15.6 per cent over the same period of 1905. A striking illustration of railroad prosperity is found in the case of the Union Pacific. From a long editorial in the *Chronicle* of December 1, on the annual report of this railroad for the year ending June 30, 1906, we compile the following interesting statements:

The results disclosed are in every way marvelous—alike as regards the income showing, the operating achievements, and the display of free assets.

On top of the large gains of previous years, we find for 1905-06 a further increase of $7,956,594, or 13.41 per cent in the gross transportation receipts and a further improvement of $2,885,535, or 10.40 per cent in the net earnings over operating expenses and taxes.

Compared with the preceding year, the surplus above fixed charges has risen to the amount of $8,979,166, or almost 40 per cent.

The aggregate of the funded debt in the hands of the public on June 30, 1906, was only $201,532,000 against $289,741,500 on June 30, 1904.

The "current assets" increased during the twelve months from $17,574,127 to $71,845,800, and the "deferred assets" from $34,664,940 to $51,172,090.

A year ago the company owed $11,198,375 on loans and bills payable outstanding. This year there are no such obligations, and the aggregate of the current liabilities of all kinds has been reduced from $24,923,600 to $20,419,100.

The above and other facts fully justify the *Chronicle* in using the word "marvelous" to describe the prosperity of this great railroad. The immense earnings would seem to justify the public in asking lower freight and passenger rates, but barring a few cases like that of the Pullman Co., we do not think that the present demand of the American people is for lower charges; it is rather for the abolition of rebates and all forms of unjust discrimination, and for improvement in the movement of freight cars. The average freight rate per ton per mile has decreased from 1.224 cents in 1883, to 0.784 cents in 1905, while the fare per passenger per mile has decreased from 2.422 to 2.028 in the same period. Hence the public is not disposed to complain of freight and passenger rates. The present agitation will not cease as long as discrimination is practiced.

Upon the question whether the railroads can afford to buy railroad supplies, the experience of the Union Pacific is worth noting.

The annual report states that new equipment has been ordered with an aggregate cost of $13,000,000. The cost of lines in the course of construction, and other lines projected, and all the additional equipment will involve an outlay of about $50,000,000. The *Chronicle* states that enormous amounts of money have been spent for the development and improvement of the property, and that results have amply repaid efforts in that direction. We agree with the *Chronicle* that this policy has been entirely sound, and that any of the railroads that are seriously contemplating a curtailment of their expenditures for new equipment, will suffer severely. Whether it is good policy to threaten curtailment of expenditures, is a point upon which men may differ. We believe that it would be wiser to be entirely frank with the people.

TO STOP FREIGHT CAR FAMINES.

The present dislocation of the pig iron trade, like all previous disturbances of a similar nature, may be traced directly or indirectly to the inability of the railroads to properly handle the freight offered for transportation. Not only does the difficulty of securing cars retard production and hinder the distribution of

the product of furnaces in blast, but it also discourages new construction which, if allowed to pursue its natural course, would bring producing capacity up to the demand. It would be folly to build two furnaces in a locality where the transportation lines cannot keep one stack regularly supplied with raw materials.

The extreme importance of the question at the present moment gives point to the arguments recently advanced by Stuyvesant Fish in favor of a national freight car clearing house for properly apportioning the equipment to the various roads. It seems that the American Railway Association is about to appoint a committee to investigate the matter. The chief cause of transportation troubles is the common practice among some of the lines of retaining and pressing into their own service cars belonging to other roads. It is proposed to empower the chairman of the clearing house to distribute equipment, so that each road shall have at command, as far as possible a number of cars equivalent to those which it has contributed.

One of the disadvantages of the plan is the immense power which would be centered in the chairmanship of the clearing house. An official able to direct the course of freight cars could control the current of commerce, and would wield a power greater than that of any ancient or modern imperial ruler. Yet conditions are such that they can scarcely be expected to mend themselves, and many railroad managers believe that the plan proposed offers the only available remedy.

NEW PLANT AT BUFFALO.

The Buffalo Brake Beam Co., one of the largest iron plants in Buffalo, has decided that in the spring it will move into a new plant to be built south of that city near the Lackawanna Steel plant. The capacity of the new works will greatly exceed that of the present plant, which is located near the city line in the north part of Buffalo. The company was started four years ago by New York steel interests and only lately completed its plant so that it could run at full capacity, but its greatly increased business in the manufacture of brake beams for railroad companies has forced an expansion.

TRADE SCHOOLS DISCUSSED

By Prominent Speakers at Quarterly Meeting of Cincinnati Metal Trades.

The regular quarterly dinner and meeting of the Cincinnati branch of the National Metal Trades Association was held at the Havlin hotel in that city on December 6. The attendance was probably the largest that ever attended one of these functions. P. G. March, of the Cincinnati Shaper Co., president of the branch, opened the meeting with a brief history of the association and its work. The Cincinnati branch is the largest in numbers, he said, of any of the branches of the national body, with the one exception of Chicago. He mentioned the effective work the association had done in the past and of the standing of the local body in the national councils and closed with an appeal to those present who were not members to join the association. Philip C. Fosdick, formerly of the Fosdick Machine Tool Co., was then introduced and presided as toastmaster.

The first speaker introduced was Hon. S. C. Dickey, of the Winona Technical Institute of Indianapolis. Mr. Dickey gave a history of the Winona Institute and the reasons for its founding. The school, he said, was not intended to give instruction in the higher branches of the various trades, but was intended to fit its pupils for a trade. A number of crafts were taught, the instruction being for both boys and girls. In reference to the management of the school and its relation to labor unions Mr. Dickey said that the open shop principle was applied and that there was no discrimination made or pledge asked of the graduates or pupils as to whether they believed in the union idea or not. It did not teach non-unionism, but simply offered the opportunity to any boy or girl who wanted to learn a trade to come to the institute and receive instruction. The school had found, however, that it was not favored by the unions and that some parents, who were members of a union, would not let their children learn a trade in the school. The school had received much support from organizations of employers in various parts of the country and was in a sense a national institution.

Mr. Dickey was followed by J. L. Ketcham, of the Brown-Ketcham Iron Works of Indianapolis. Mr. Ketcham said that in the matter of trade schools this country was far behind other countries notably Germany. One of the needs of the school, he said, was boys to learn the trades and he advanced the idea that as there was no trade school in Cincinnati where the foundry trade could be learned, boys be sent to Indianapolis. Mr. Ketcham said that in his investigation he had learned that the only other effort along the line of trade training in the foundry trade was made at the state reform school at Jeffersonville, Ind.

E. F. DuBrul, formerly commissioner of the National Metal Trades Association, made a forceful talk on value of organization. He heartily endorsed the work of the Winona Institute. He advanced the idea that, no matter where the school was located, the question was not local but national in its bearing; that the need for young men in the crafts was already apparent to every employer and wherever the facilities were offered that was the place to send the boys and that the support and encouragement of the work was the duty of all who were in sympathy with such an effort.

O. P. Briggs, president of the National Founders' Association, was the next speaker. He said that the association which he represented had regarded the Winona Institute as a strictly business proposition. During a strike or a shortage of labor in any craft, the employer was put to the necessity of going all over the country to get men to man his shops. He simply in this way shifted the supply of men from one place to another, but did not make any more molders or machinists or printers or lithographers. The remedy he believed apparent. The events which had transpired in the recent past, which so vitally affected his association, had made it clear to many of its members that what they needed to do was to make molders. The Winona Institute with its ground, its buildings—an established institution—afforded the opportunity for the training of young men and boys in this craft and his association had done something to encourage the enterprise.

Prof. Shearer, of the Mechanical Institute of Cincinnati made a brief talk on the duty of the teacher in such schools as his and other trade schools of co-operation with practical men in actual business to ascertain the needs of the manufacturer in the way of skilled labor and to as far as possible train the boy in the school to do those things which would be required of him when he went to work in the shop.

Howard Saxby, a humorist of more than local reputation, added to the pleasure of the evening with one of his characteristic after dinner talks.

BUY ARMOR PLATE ABROAD.

Secretary of Navy Suggests Solutions of the Question in Annual Report.

In a report transmitted to the president during the past week by Secretary Bonaparte of the Navy Department the armor plate question is dealt with at length. The secretary discusses the advisability of the government establishing an armor plate plant of its own, in which connection the report of a special board appointed by the government to investigate this question is of interest. The board states that a plant with a capacity of 6,000 tons annually could be constructed for $3,750,000 and that armor plate could be manufactured at $295 a ton. The last lot contracted for cost the government $345 a ton.

Secretary Bonaparte reviews the history of armor plate contracts for the past few years, explaining the reasons for the peculiar style of recent awards. Concerning his division of the last awards, one-half going to the Midvale Steel Co., and one-quarter to each of the Carnegie and Bethlehem Steel companies, he says:

"In reaching this conclusion, I was influenced partly by the fact that the Midvale company was a little behind in its deliveries under previous contracts; but, namely, by the probability that if no work were given to the old companies—since the government was their only customer and they would soon complete their deliveries under contracts already given out—they would transform their plants for the production of armor plate and devote them to other products, thus reducing the facilities for the production of an article essential to the national defense and leaving the government no source of supply except the Midvale company."

Attention is called to the need of some effective means for defense against combinations among producers, the secretary stating that "when there are only two or three of the latter in the whole country and the government is the only purchaser, it is obvious that combinations are almost inevitable." As to the course to be pursued, the secretary makes the following suggestions:

"There are only two ways in which it is practicable to control such a situation—either the government must be authorized to manufacture its own armor plate or it must be permitted to buy this abroad. I recommend that both privileges be accorded to the department. The first mentioned would be, however, probably ineffectual, since not only would the cost of establishing a government plant greatly exceed any difference in the price of the product which could be obtained in a single year, but the delay attendant upon the establishment of such a manufactory would be very objectionable, and might involve expensive complications with the contractors building the ships on which the armor would be used; and, finally, experience has shown that there are serious drawbacks to the permanent operation of a plant of this character by the government.

"If, however, the secretary of the navy were authorized to buy armor plate abroad whenever, in the judgment of the president, the price at which he could obtain such armor plate in the United States was exorbitant or unreasonable, there is good reason to believe that the manufacturers either would not form a combination at all or agree upon a reasonable and moderate price. I would extend the like authority to the purchase of torpedoes, ammunition, projectiles, and, in fact, all articles necessary to the national defense."

The recommendation is made that congress authorize the construction of a sister ship to the one already authorized, and it is further suggested that "a moderate increase in the effective fighting power of our navy is the part of patriotic foresight."

PROPOSED MACHINERY EXCHANGE BUILDING.

A preliminary meeting looking toward the collection of the many offices of machinery firms in New York under one roof, and the creation of a machinery club, warehouse and general headquarters for the trade was held at the rooms of the New York Board of Trade and Transportation on Thursday, Dec. 6. F. H. Stillman, president of the Watson-Stillman Co., had issued a circular setting forth the objects of the meeting and a goodly representation of the trade assembled. K. B. Conger, representing the Hudson companies, offered the entire Fulton building the smaller of the two structures now being erected as terminals of the McAdoo tunnels, running from Jersey City under the Hudson river to Church and Cortlandt street, New York, for a home for metal and machinery firms.

Steps were taken to form an association to take over 400,000 square feet of floor space, to be divided into offices and such other rooms as may prove desirable The Hudson companies offered in addition an eight-story warehouse to be built in Jersey City, where the products of the various firms having offices in the New York building may be stored and exhibited.

Cut for Relining.—Stack A of the Buffalo Union Furnace Co., after working badly for three months, has been blown out and found to be in very bad condition. About thirty days will be required for relining.

PHILADELPHIA FOUNDRYMEN

Plan for Entertainment of American Association.—Officers are Nominated.

Plans for entertaining the annual convention of the American Foundrymen's Association, which is to be held in Philadelphia next May, were discussed at the monthly meeting of the Foundrymen's Association of that city, which was held at the Manufacturers' Club Dec. 5. Dr. Richard Moldenke, secretary of the National Association, and H. M. Lane, secretary of the Foundry Supply Association, were present and spoke of the great interest felt in next year's convention. A movement is under way, Dr. Moldenke said, to form an association of brass foundrymen, and it is expected to have 200 to 300 of them in attendance, while he estimated the number of foundrymen likely to be present as fully 1,000. Mr. Lane, speaking for the Supply Association, said that the work was progressing; very satisfactory replies had been received from dealers in answer to letters sent out, and applications for space were already coming in. The Second Regiment Armory had been leased and some outside ground secured. The interest shown was greater than ever before and he predicted a large attendance. In answer to questions he said that the rates for space for exhibition purposes had been fixed as follows: 100 square feet, $15; 200 feet, $25; 300 feet, $35; 400 feet, $40.

In a discussion as to finances, in which Stanley Flagg Jr., President Devlin and others joined, it was estimated that from $3,000 to $4,000 would be required for the proper entertainment of the guests, and it was decided that vigorous efforts should be made to raise as much money as possible after the first of the year.

The present officers of the association were unanimously recommended as follows, (to be elected at the January meeting): President, Thomas Devlin; vice president, Alex. E. Outerbridge Jr.; treasurer, Josiah Thompson; secretary, Howard Evans; executive committee, H. O. Evans, Thomas M. Eynon, E. E. Brown, R. C. Olphant, George C. Davis; trustees, Thomas Devlin, Josiah Thomson, Howard Evans; official chemist, George C. Davis. Albert M. Moyer, representing R. T. Randall & Co., of New York, was elected to membership.

E. H. Mumford, of the E. H. Mumford Co., gave an interesting talk on "The Rathbone Multiple Molding Machine," illustrated by lantern slides, and J. W. Daniels read a paper on "Sheet Steel Adjustable Flask Jacket," an invention for which H. C. Caldwell, of Philadelphia, has made application for a patent.

CARNEGIE'S "OLD BOYS"

Enjoy Their Fifth Annual Dinner.—Medals Presented "the Real Hero."

Thirty-six of Andrew Carnegie's still youthful veterans gathered at the great house at Fifth avenue and 90th street, New York, for the fifth annual dinner of the Carnegie Veteran Association, Friday evening, Dec. 7. The guests were received by Mrs. Carnegie and her sister, Miss Whitfield, and at half past seven all were seated in the big banquet hall on the ground floor. The events of the evening were the presentation of bronze, silver and gold "hero" medals, duplicates of those used by the Carnegie Hero Fund organization, to Mr. Carnegie, by C. L. Taylor, of the fund commission, and the reading of humorous verses by W. B. Dickson, the "poet laureate" of the association, and in daily life second vice president of the United States Steel Corporation.

Mr. Carnegie sat at the head of the table with William E. Corey, president of the United Steel Steel Corporation, on his right, and J. H. Reed, chairman of the Carnegie board, on his left. Those at the table besides the gentlemen named were: C. W. Baker, W. R. Balsinger, W. W. Blackburn, H. P. Bope, L. T. Brown, J. J. Campbell, A. C. Case, D. M. Clemson, W. B. Dickson, A. C. Dinkey, John C. Fleming, R. A. Franks, James Gayley, A. R. Hunt, J. G. Hunter, D. G. Kerr, F. H. Kindl, Thomas Lynch, E. S. Mills, A. Monell, Thomas Morrison, George E. McCague, W. C. M. Clausland, John McLeod, G. D. Packer, A. R. Peacock, L. C. Phipps, James Scott, Emil Swenson, C. L. Taylor, H. E. Tener Jr., E. H. Utley, G. H. Wightman and E. F. Wood.

Mr. Carnegie began the speaking by felicitating his "boys" on their successful careers, and created general good humor by means of many intimate allusions to the common history of the past. He was followed by Mr. Corey, who spoke of the unexampled prosperity of the times. Then Mr. Dickson read his poem, for which many presses are hungry but which the author declares, will never be printed. It seems to have dealt vigorously with the big men and the big events of the year. A. C. Dinkey, president of the Carnegie Co.; James Gayley, first vice president of the U. S. Steel Corporation; L. C. Phipps, and L. H. Reed spoke extemporaneously.

C. L. Taylor, of Pittsburg, president of the Carnegie Hero Fund Commission, introduced a serious note into the evening's proceedings. He thanked Mr. Carnegie in the name of the commission for his great work for recognition of all that is best in human nature. After presenting to Mr. Carnegie duplicates of the gold, silver and bronze medals which the commission distributes to the worthy, Mr. Taylor said:

"Mr. Carnegie, to us, is the real hero. He is our leader. He is our ideal of manhood. In his benefactions, in his good work for the uplifting of humanity, he has probably saved as many lives and bestowed as many blessings on humanity as any persons whom he can ever reward."

GRAHAM NUT CO. ENLARGES.

Graham Nut Co., with general offices in Pittsburg and works located at Neville Island, Pa., has made arrangements to enlarge its plant. The improvements, when completed will practically double its output. Two new buildings will be constructed, one to be 60 x 200 feet and the other 95 x 100 feet, in which will be installed entirely new equipment consisting of several hot pressed nut machines, cold punched nut machines and several classes of bolt heading machines of the latest type. Trade conditions have made this move necessary and it is expected to have the addition in operation by April 1, 1907. The buildings will be of brick and steel constructions. J. M. Stetter, general superintendent of the Indiana Works of the Republic Iron & Steel Co., has resigned his position, to take effect at an early date, and has associated himself with the Graham Nut Co. He will be general superintendent of the Neville Island plant and have charge of the new construction. The present officers are Albert Graham, president; Harry C. Graham, treasurer, and Chas. J. Graham, secretary. With the additional equipment arranged for, this company will cover the general bolt and nut line thoroughly.

Land for New Furnace.—E. J. Bird, vice president and general manager of the Bird Iron Co., states that the new furnace which he and associates will erect in the Hanging Rock district, southern Ohio, will have a capacity of 80,000 or 90,000 tons annually. The new company has acquired 3,000 acres of land upon which are valuable deposits of coal, limestone, shales and clays suitable for brick, cement and pottery. The coal mine is now producing about 200 tons per day, but this will be increased to 400 or 500 tons.

RIPPEL STEEL FOUNDRY CO.

The E. G. Rippel Steel Foundry Co., Buffalo, was incorporated during the past week with a capitalization of $50,000 and with E. G. Rippel, J. V. Rippel and W. C. Miller, all of Buffalo, as directors. The new company has leased the plant of the O'Brien Foundry at 31-39 Indiana street and a general business will be done in the manufacture of steel castings of the smaller class of the crucible process. It is expected the pouring off will begin the last week of this month and delivery to the trade Jan. 1. The O'Brien plant is now being overhauled in a way that will make the new proposition one of an up-to-date character. Oil furnaces will be used.

The O'Brien Foundry is one of the oldest in Buffalo. Thomas J. O'Brien was proprietor and he retires from the business, for the present at least. E. G. Rippel recently disposed of his interests in the Buffalo Foundry Co. and the Buffalo Crucible Casting Co., of both of which he was the organizer. His brother, J. V. Rippel is also experienced in the foundry business. W. C. Miller came to Buffalo from Melrose, Ill., where he was connected with the Latrobe Steel Co. He was foundry foreman at the Buffalo Crucible Casting Co.

TWO IMPORTANT MEETINGS.

Two important New York meetings this week are of interest to the Birmingham district. The directors of the Alabama Consolidated Coal & Iron Co. are to hold a meeting and elect a president to succeed Col. T. G. Bush, whose proposed retirement was announced some time ago. It is understood that Morris Bush, son of Col. Bush, is to be general manager of operations of the company and that a Baltimore man is to be president of the concern. The other meeting is that of the Sloss-Sheffield Steel & Iron Co. The regular quarterly dividend will be authorized and the election of a vice president to succeed M. M. Ruchey, who returned to the service of the Southern railway as general superintendent a few weeks ago, will come up. There is no change in the belief that J. W. McQueen will be advanced to the position of first vice president and will continue also as general sales agent.

M. A. Hanna & Co., Cleveland, have secured the exclusive sale of the output of the Perry Iron Co., now building a merchant stack at Erie, Pa. It is hoped that this furnace will be ready to blow in by July 1.

COURT HOLDS AGAINST THE MOLDERS' UNION.

An important decision was recently handed down at Meadville, Pa., by Judge F. J. Thomas, of the common pleas court, in the case of the Meadville Malleable Iron Co. vs. L. Baldenwick et al, and the Iron Molders' Union of North America, Local Lodge No. 369. This suit was brought as the result of numerous assaults growing out of picketing of the malleable works after its proprietors had announced that it was to be operated as an open shop. The court held that the defendants must be restrained from picketing, from the use of vile language and from attacks upon employes as well as from interfering with or intimidating employes or prospective employes by inserting false advertisements in newspapers. This last injunction referred to widely-circulated advertisements urging molders and coremakers to keep away from Meadville because of a "lock-out," when in fact no lock-out existed. The defendants were assessed the cost of the proceedings. In discussing the case the judge held as follows:

"The defendants had no more legal right to fix the prices that plaintiff should pay for its work than the plaintiff had to determine the rules and regulations of the union to which most of the defendants belong. Nor did the plaintiff have any more legal right to compel defendants to work for it at a specified rate, or at any rate at all, than defendants had to determine that plaintiff must give them employment and pay them therefor, whether they had work for them or not.

"Picketing, if properly done is not per se unlawful. It is a dangerous weapon which is seldom safely handled, and then only by well-disciplined and cool-headed men. A single individual may make it a grave danger, and even outsiders, who have more enthusiasm than discretion, may make it a nuisance that demands suppression."

Labor Notes.

The furnace employes of the Crane Iron Co., at Catasauqua, Pa., have been granted an advance of ten per cent dating from Jan. 1.

The Empire Foundry Co., New Brunswick, N. J., has given its molders a five per cent increase in wages. An increase has also been granted to employes of the American Iron & Steel Mfg. Co., Lebanon, Pa.

Polishers of the Columbian Hardware Co., Cleveland, recently made a demand for a nine-hour day. The matter was referred to the National Metal Trades Association, whereupon the demand was abandoned and the men returned to work.

Dewitt C. Badger, mayor of Columbus, O., was recently assaulted by Charles Miller, chairman of the strike committee. Molders in that city have been on strike for some months, and the city authorities have frequently been compelled to interfere to prevent serious trouble. This was probably the cause of the assault, which was entirely unprovoked.

The difficulties over rates for puddling in the Reading, Pa., district have been settled and the three mills of the Reading Iron Co. have resumed operations. The rate is really $2.87 per ton for puddlers and $1.72 for helpers. The men have been idle practically since July 1, and the company in its recent general advance made the above rates which were immediately accepted with few exceptions, this puts the mills in eastern Pennsylvania in the $4.50 per ton class. Difficulties have been adjusted at Danville, Lancaster, Milton and other places, although there are still disputes at New Haven, Conn., and Baltimore.

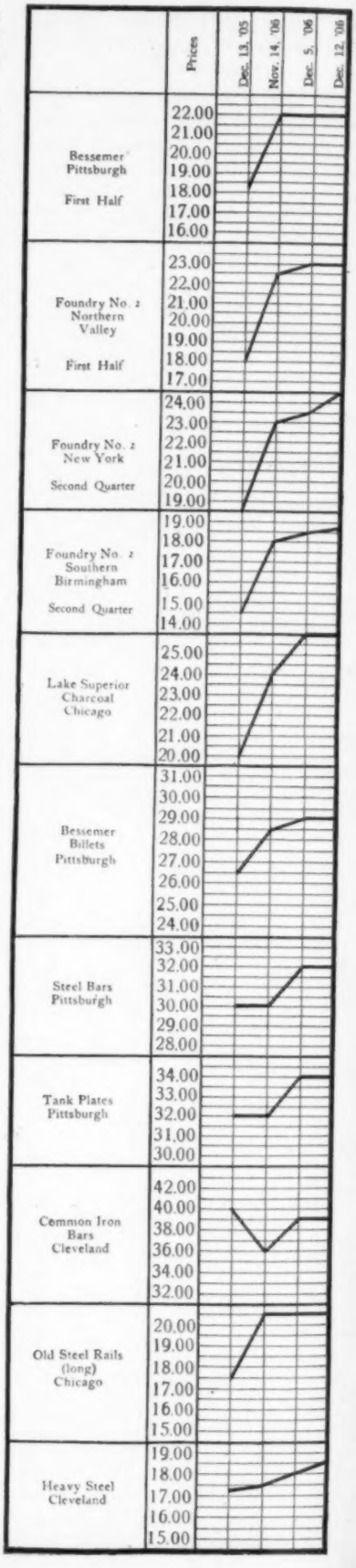
JOINT SUPPLY MEETING.

The Southern Supply & Machinery Dealers' Association will hold its next annual meeting at Cincinnati, May 8, 1907, and, according to recent arrangements, annual meetings of the National Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers' Association will be held at the same time and place. As a result, the joint gathering will doubtless be the largest meeting of supply men ever held, while representative manufacturers from all parts of the United States will attend. The membership of the Southern Association has largely increased of late, 21 concerns having been recently enrolled, while the other associations have also enjoyed a healthy growth.

Steel Works to Start.—Follansbee Bros. Co., Pittsburg, has been considerably embarrassed of late by reason of wide publicity given in an erroneous statement that a fire had occurred at its plant at Follansbee, Va. The error originated, no doubt, through the report of the plant of the Sheet Metal Specialty Co., some distance from the Follansbee plant. The latter is preparing to start its new steel works in connection with its mills, thus largely increasing its output.

Erie's New Industries.—During the fiscal year ending with June 30, last, there were located along the line of the Erie railroad 122 industrial establishments, 89 of them being manufacturing plants. Since that date construction work has been begun on a number of additional enterprises.

PRICE CHART.


Prices
Dec. 13, '05
Nov. 14, '06
Dec. 5, '06
Dec. 12, '06
Bessemer Pittsburgh First Half
22.00 21.00 20.00 19.00 18.00 17.00 16.00
Foundry No. 2 Northern Valley First Half
23.00 22.00 21.00 20.00 19.00 18.00 17.00
Foundry No. 2 New York Second Quarter
24.00 23.00 22.00 21.00 20.00 19.00
Foundry No. 2 Southern Birmingham Second Quarter
19.00 18.00 17.00 16.00 15.00 14.00
Lake Superior Charcoal Chicago
25.00 24.00 23.00 22.00 21.00 20.00
Bessemer Billets Pittsburgh
31.00 30.00 29.00 28.00 27.00 26.00 25.00 24.00
Steel Bars Pittsburgh
33.00 32.00 31.00 30.00 29.00 28.00
Tank Plates Pittsburgh
34.00 33.00 32.00 31.00 30.00
Common Iron Bars Cleveland
42.00 40.00 38.00 36.00 34.00 32.00
Old Steel Rails (long) Chicago
20.00 19.00 18.00 17.00 16.00 15.00
Heavy Steel Cleveland
19.00 18.00 17.00 16.00 15.00

STRONG AND BRISK.

British Iron and Steel Markets Active With Higher Prices.

Birmingham, England, Dec. 1.—The iron business continues strong, makers being concerned not as to the getting of the orders but as to obtaining of the necessary metal to execute contracts. Some firms have recently sent urgent messengers around from merchant to merchant with the object of getting sufficient material to keep their works going. One of them was saved from absolute stoppage by the purchase of a truck. American buying is mainly responsible for the scarcity of pig iron, a northern report stating that various firms in Boston, Philadelphia, Baltimore and New York, have contracted with Glasgow houses for the shipment of between 30,000 and 40,000 tons, mostly foundry qualities with some hematite. Last week 10,000 tons were sold, and many thousands of tons have been declined owing to inability to give delivery. Several special steamers have been chartered, quite a new experience for Glasgow shippers. Within the past few days one-fifth of the entire Glasgow stock has been purchased by New York merchants at 63s a ton, the highest price for many years. A cargo of over 4,000 tons has been sold for New Orleans, the first of the kind since 1879. Fortunately for this country, there are still heavy stocks of Cleveland iron, but they are melting away, and it is quite likely that within a few months there will be a general scramble to monopolize what remains. In the meantime, the Germans have cleared out Northampton stocks, and orders for Derbyshire pig are on offer which makers cannot accept. Sellers in the Midland district who have any pig iron to offer can easily get a couple of shillings per ton on recent prices.

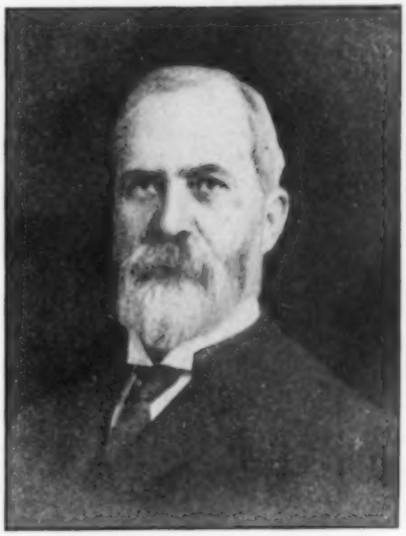
The dear pig iron has stiffened the backs of the unmarked bar makers, who have now declared an advance of 5s, making the price £7 5s. They will have to secure this, if they are to get any profit out of the iron, in view of the dearness of raw material. The Unmarked Bar Association is also making an attempt to induce the Lancashire houses to raise their prices for shipments, the present figure, it is said, being at least 7s 6d below what it should be, to cover freight charges to the coast. At present, the Midland ironmaster is driven out of the foreign market, as far as bars are concerned.

Steel Prices Higher.

Steel is rapidly rising in price. The South Wales Siemens Steel Bar Association has raised the price of tin bars 5s per ton, making quotations £6 2s 6d, but deliveries are difficult to get. The advance has been followed here by the local makers, and the effect has been to raise tin plates 3d per box, making the price 15s unassorted. Galvanized sheets are still booming, and prices are £13 5s or 15s above the minimum; a further advance may be declared soon. In the rolling-stock trade there is some falling off, the position being very different in regard to order reserves to that of a year ago, but there are still fair reserves of orders in hand. Trade is being checked somewhat by the high bank rate, and dear materials.

HENRY J. HENDEY DEAD.

Henry J. Hendey, president of the Hendey Machine Co., Torrington, Conn., died suddenly on Saturday morning, Dec. 8, at the age of 62. He had been ailing for several months



H. J. Hendey.

but was thought not to be in immediate danger until shortly before death came. Mr. Hendey was one of the pioneer manufacturers of Torrington and with his brother, Arthur J. Hendey, was the chief factor in the organization of the Hendey Machine Co., of which he had been president since 1883. He is survived by a widow, two daughters and a brother. Burial took place at Torrington, on Wednesday, December 12.

William Allen, president of the Wm. Allen & Sons Co., boiler manufacturer, of Worcester, Mass., died Nov. 27.

George Palm, president of the Palm Gas Engine Co., Pittsburg, died suddenly Dec. 5 at his home in Butler, Pa. He was the patentee of a number of oil well tools and supplies which bear his name.

Charles Donnelly, one of the leading business men of Pittsburg, died Dec. 5 at the age of 65. He was born in Ireland, coming to America in 1848, where he early engaged in railroad work. In 1882 he entered into partnership with McClure & Co., manufacturers of Connellsville coke. Later he organized the Pittsburg Terminal Railroad & Coke Co., of which he became president, and was also one of the founders of the Federal Coal & Coke Co., and the Thompson Connellsville Coke Co.

Rufus W. Gillett, president of the Detroit Copper & Brass Rolling Mills and vice president of the American Harrow Co., died Dec. 3 at his home in Detroit, after a business career of 45 years. He was born in Connecticut in 1825, and came of a noted family. From 1856 to 1862 he was secretary and treasurer of the Wolcottville Brass Co., leaving that position on his removal to Detroit. He was twice president of the Detroit Board of Trade, was the first president of the Detroit Chamber of Commerce and was president of the Preston National bank in addition to his other industrial connections.

STEEL CORPORATION IMPROVEMENTS.

(Continued from page 1.)

American Steel & Wire Co.

At the Waukegan works a factory for the manufacture of insulating wire and cable.

At the Central furnaces, Cleveland, extensions to the dock and a new power plant.

In the Cleveland district there will also be erected a new mill for rolling flats for cold rolling.

At Worcester, Mass., new rod mills.

Lorain Steel Co.

At Johnstown, Pa., extensions and improvements to the plant which will practically double its capacity.

American Bridge Co.

At Elmira, N. Y., the construction of a new plant.

May Advance Wages.—At a meeting of representatives of valley furnace interests, held at Youngstown, O., Dec. 6, the question of increased wages for furnace operatives was considered at length. Although no definite decision was reached, the impression prevails that an increase of 10 cents per day will be granted, to become effective about the first of the year. This does not affect common labor, however, as on this subject no policy has as yet been settled upon. The increase will be entirely of a voluntary nature, no demand having been made by employes, and will come as a recognition of the advanced cost of living.

PERSONALS.

H. A. Flagg has been appointed manager of sales of the Shelby Steel Tube Co., Pittsburg, in charge of the New York office.

J. B. Ayres, for some time connected with the National Tube Co., at McKeesport, has been appointed superintendent of the construction and mechanical departments.

R. L. Reel, formerly superintendent of the Sodemann Heat & Power Co., Edwardsville, Ill., has become superintendent of the Belleville Foundry Co., of Belleville, Ill.

Noah Swayne 2d, of Philadelphia, has resigned as president of the Nittany Iron Co., and has been succeeded by John Kennedy, general manager of the Punxsutawney Iron Co., Punxsutawney, Pa.

Edmund Raftery, vice president of Rathbone, Sard & Co., served as toastmaster at a banquet recently tendered by that company to its traveling salesmen at the hotel Arthur, Aurora, Ill.

Col. E. P. Wilson, secretary of the Manufacturers' Club, Cincinnati, who has been dangerously ill at his home near that city for several months, will shortly leave for Daytona, Fla., to spend the winter.

George W. Douglas, who for the past two years has been connected with the sales department of Rogers, Brown & Co., Cincinnati, will on Jan. 1, 1907, occupy a similar position with the St. Louis office.

Fred W. Bauer, for two years past connected with the St. Louis office of Rogers, Brown & Co., will return Jan. 1, 1907, to Cincinnati and represent that company in the same territory as before going to St. Louis in 1905.

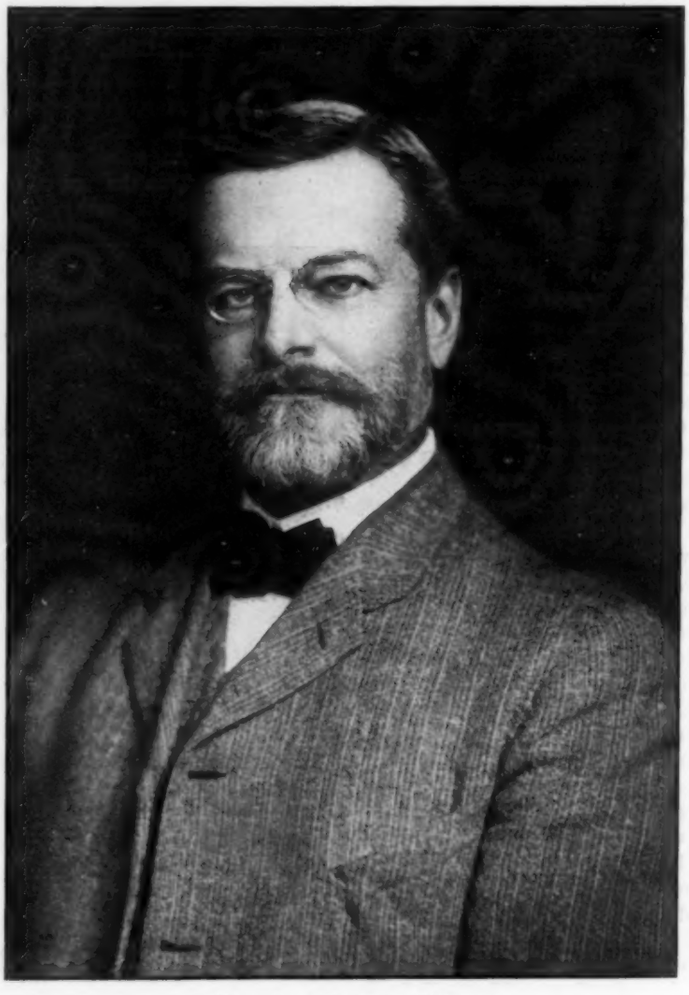
W. C. Price, of the Poole & Price Machine Co., 36 Hartford street, Boston, retired, has been succeeded by Harry Pothecary, for a number of years with the Brainard Machine Co., and later with the La Point Machine Tool Co.

J. A. Gunn has resigned as general agent for Iowa for the J. I. Case Threshing Machine Co. to take effect Jan. 1, and will then become treasurer of the Gould Balance Valve Co., Kellogg, Ia., of which he is one of the principal stockholders.

Harry Wright, district manager of the American Steel Foundries, recently tendered a banquet to the superintendents and other officials of the Sharon, Pittsburg and Alliance plants, which, during October and November, broke all records for production.

S. Henry Harrison, formerly superintendent of power and machinery of the Vulcanite Portland Cement Co., Vulcanite, N. J., has associated himself with the Osborn Engineering Co., Cleveland, and will have charge of cement plant designing and engineering. The company is now designing a large cement plant for the Pacific coast.

W. J. Totten, for many years manager of the St. Louis office of the Carnegie Steel Co. and of the Illinois Steel Co., has been made assistant manager of sales of the latter, with headquarters at Chicago. W. B. Weston, manager of the New Orleans office of these two companies, will succeed him, while J. R. Mills Jr., assistant manager of the St. Louis office, will succeed Mr. Weston. These changes are effective Jan. 1.



FREDERICK REMSEN HUTTON.

Recently Elected President of American Society of Mechanical Engineers.

May Erect Two Stacks.—Directors of the Youngstown Sheet & Tube Co., Youngstown, O., will meet Jan. 10 to vote on the proposed increase in capitalization from $4,000,000 to $6,000,000. The extra capital is to be applied in making additions to the plant in which connection it is stated that two stacks will be erected.

DOMINION SETTLEMENT.

The difficulty between the Dominion Iron & Steel Co. and the Dominion Coal Co. over the agreement for the supply of coal has been temporarily settled by the adoption of a working agreement under which the steel company will obtain coal sufficient for its requirements for the next two years of the qualities desired, on payment of a considerably increased rate which is given as from $2.25 to $2.50 per ton according to grade, in place of the former contract rate of $1.24. The steel company still maintains the validity of the old contract and will bring suit in the courts to enforce it and, if successful, will demand the repayment of the excess over the old rate.

Creditors of the Continental Iron Co., Wheatland, Pa., which failed in 1898, will realize about 30 cents on the dollar. The referee in bankruptcy has passed on the final claims and directed a final dividend.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

PRESIDENT TAYLOR'S ADDRESS A MARKED FEATURE.

Wide Variety of Topics Keenly Discussed.—Interesting Excursions Enjoyed.—An Especially Successful Meeting.

Meeting for the fifty-third time, the American Society of Mechanical Engineers held its convention in New York Dec 4 to 7 with a larger attendance than ever before, as prophesied in the last issue of the IRON TRADE REVIEW. The place of meeting in the Edison auditorium on Twenty-seventh street, taxed last year in the matter of capacity, was not more crowded than was the convention, with matters of interest to those attending. The opening session as recounted last week, was devoted to the address of President Taylor, which in itself will characterize the 1906 meeting.

Discussion on Taylor Paper.

The second session was called to order at 10 o'clock Wednesday morning in the convention hall as appointed. After the transaction of some routine business President Taylor's paper on "The Art of Cutting Metals" was thrown open to discussion. A brief abstract of this paper was given in the IRON TRADE REVIEW last week and the paper itself is given in greater detail on another page of this issue. The paper produced a great amount of discussion, which was contributed by engineers from England as well as those of this country. President Taylor called Vice President Barrus to the chair in order that he might reply to some of the discussion as it was presented.

Henry R. Towne stated that Mr. Taylor's paper was a masterpiece and the subject related to the foundation on which all our metal-working industries are built. The title of the paper does scant justice to the scope of the work which it records, for incidental to its main purpose this work included subordinate investigations hardly less radical, even if of less importance, than the main issue. Chief among these was the development of what is now best known as the Taylor system of shop management. Calvin W. Rice presented some details of the workings of the Taylor system in the Sayles Bleacheries near Pawtucket, R. I. The increase in output due to the use of the system was, in many cases, five-fold, and the increase in the wages of operatives from 20 per cent to 40 per cent.

Daniel Adamson of Hyde, Cheshire, England, presented a discussion in which he took exception to some of Mr. Taylor's criticisms of the work of the Manchester committee. He defended the consideration of the area of the cut as a single variable, and quoted from the Manchester report in support of his contention. He also criticised some of Mr. Taylor's methods and compared them with those used by the Manchester committee. R. A. Skeggs of Vickers Sons & Maxim, Ltd., Sheffield, Eng., also contributed a discussion in which he defended the work of the Manchester committee. He also inquired whether Mr. Taylor had developed any formulae for obtaining speeds when scale, uneven hardness, and sand, are to be found in the forging.

Effect on the Workman.

John T. Hawkins stated that Mr. Taylor's ideas, if carried to a radical conclusion, would ultimately eliminate, or at least very greatly emasculate, the real mechanic. This type of mechanic has, in these days of labor-saving machinery, largely disappeared. Mr. Hawkins did not advocate that every mechanic should, at the present time, be expected to "know it all," but maintained that it was no less essential that the mechanic still should be, to whatever comparatively narrow field he might be confined, an intelligent, brainy, "finger-wise" man. If a man whose capacities were only sufficient to operate under the slide rule system were told that he could get a job, where, while increasing his employer's profit by forty per cent he could add to his own receipts thirty-five per cent, he would be sure to jump at such a chance. Mr. Hawkins then discussed the effect of Mr. Taylor's system upon the labor question and expressed the opinion that if it was ultimately adopted throughout the country, it would completely eliminate the labor union.

Fred M. Osborn of Samuel Osborn & Co., Ltd., Clyde Steel Works, Sheffield, Eng., gave a brief history of the development of Mushet high-speed steel.

M. Le Chatelier, Paris, France, presented a discussion in which he commended Mr. Taylor's work and discussed in considerable detail the effect of the addition of tungsten and vanadium to steel. He stated that the composition recommended by Mr. Taylor differs notably from the preceding steels, the percentages in carbon, in chromium, and in tungsten being nearly 50 per cent greater. The most important new point, however, is the addition of a small quantity of vanadium and the absolute exclusion of molybdenum, which formerly had been considered as being rather superior to tungsten. He stated that Mr. Taylor's observation regarding the absence of any relation between the quality of the tool and its micrographical structure is not surprising, the same being true of carbon steels. One must not conclude, however, that the investigation of the physico-chemical properties of tool steels is useless.

Future of the Mechanic.

President Taylor at this point took occasion to reply to Mr. Hawkins' discussion regarding the elimination of the "finger-wise" mechanic, by pointing out to the meeting the presence of about twenty young men from the shops of the Link-Belt Co. and the Yale & Towne Mfg. Co., who had developed under the Taylor system. These men, Mr. Taylor said, were mechanics of the highest order and superior to the average machinist found in the shops. They had been developed entirely by the Taylor system and he protested against the assumption that this system would eliminate the skilled mechanic.

H. K. Hathaway spoke of some of the difficulties encountered by a foreman who attempts to use higher speeds and heavier cuts as outlined by Mr. Taylor. He referred to his experience in a shop, after he had left the Midvale Steel Co., where light cuts and slow speeds were in vogue as well as many peculiar shapes of tools. When he attempted to bring things up to the speeds which were in use at Midvale he encountered every conceivable obstacle, both from the men and machines, and reached the conclusion that the only way to increase the output of a shop by the use of heavier feeds and speeds was to make the change gradually, one step at a time, until the whole object was accomplished. This usually is a work extending over a number of years and the greatest patience must be exercised while it is being carried out.

Pressure on a Tool.

M. Codron of Paris in discussing the

paper stated that there had been discovered a law relating to the pressure on a tool. According to the tests of Mr. Nicholson the pressure on tool decreased as the speed increased, at first rapidly and then more slowly. The test carried out by M. Codron indicated the reverse, and later that same law was found to be true for punching and for boring. This was discovered by other experimenters as well as M. Codron.

H. L. Gantt, who was associated with Mr. Taylor in his experiments, presented a discussion which dealt with the task system of management as outlined in the Taylor system. After this the paper was thrown open for general discussion and Oberlin Smith stated that next to the high-speed steel it is the belt driving the machine that is of the greatest importance. If there was not sufficient pulling power the steel could not be made to work up to its maximum limit.

True Work at High Speed.

Mr. Huson told of the difficulty of getting true work with high speed steel where very close limits of accuracy were required. He told of the work done by him on printing presses and stated that when it was attempted to machine certain parts with high speed steel these pieces sprung after being released from the machine and had to be scraped and filed to accuracy. As Mr. Taylor's experiments had been devoted principally to heavy, roughing work, he would like to inquire what could be done on close work? Mr. Huson then replied to Mr. Hawkins saying, that the all-around mechanic as found today was "no good," that he was a "jack-of-all-trades and master of none."

Mr. Taylor in closing the discussion stated that the experiments outlined in his paper were only an incident in the attainment of the main object, that was the investigation of the proper method of obtaining the maximum output of a shop. Replying to Mr. Huson he stated, that if Mr. Huson would be prepared to carry on experiments extending over a period of say—six months—and if he would be willing to consign a considerable number of pieces to the scrap heap, he would, at the end of that time, find out how to machine fine work with high speed steel. This closed the discussion of President Taylor's paper, and the meeting then adjourned to the lower floor, where lunch was served.

Evolution of Gas Power.

The third session convened Wednesday afternoon at 2 o'clock and the first paper presented was on "The Evolution of Gas Power," by M. F. E. Junge. The object of this paper is to give a brief survey of the course of development and the extent of application which the gasification of fuels and their direct transformation into energy in gas engines has found up to this date. In the introductory part, the importance of fuel conservation as an economic national and international aim is considered. The first section is devoted to considerations on the present working cycles of gas engines and their probable future modification, and to the criticism of what is now regarded as the standard type. In the second part the development of the gas producer is discussed, and its present deficiencies and the path for future improvements outlined. The third part is concerned with the application of gas power in the different commercial pursuits, and in the varied industries.

This paper was also productive of considerable discussion. R. C. Carpenter outlined a history of the Brayton gas engine and the life of George W. Brayton, the inventor. W. D. Ennis stated that two papers presented at the meeting contained results, which, if secured concurrently, would give an efficiency equal to that of the best gas engine practice. What is needed in both boiler and engine practice is not so much new record-breaking efficiency, as a nearer approach to good efficencies, such as indicated in the papers mentioned, in ordinary plant operation. This is becoming a matter of load factor so far as engines are concerned, and of air supply regulation and boiler operation. H. E. Hellmund cited some instances of the failure of a gas engine in electric light plant and discussed the reasons for these failures. Prof. H. Diederichs presented a mathematical discussion on the Otto cycle.

In Blast Furnace Work.

J. E. Johnson Jr. presented a discussion treating of the use of gas engines in connection with blast furnaces. He said, in part:

"As far as blast furnaces are concerned, the top of the furnace has been closed, for the purpose of leading off the gases to points of utilization, for 30 years in the writer's personal recollection, and for 15 or 20 years before that time. As regards the method of transformation it has, in many cases, been very wasteful, the poorest types of boilers, the most uneconomical type of engines being employed by the furnace, but blast pressures have increased, demanding more work from the blowing engine. The economy of the machinery has been increased in much greater ratio, so that up to ten or fifteen years past there has been a strongly marked tendency at every works which desired to keep up with the procession, to install an economical type of boiler—generally the water tube—and cross-compound blowing engines with Corliss valve gear, a combination which it is safe to say will yield a horsepower with one-quarter the quantity of gas employed under the old regime. This tendency is so universally prevalent that the standard of comparison with the gas engine must no longer be the old type of uneconomical boilers and engines, but the best modern type of steam machinery, whose consumption of water would not be more than 16 pounds per horsepower-hour. That the gas engine has decided advantage in fuel economy over an engine even of this type, is not to be denied, but it seems probable that the advantage is not in the ratio of 3 to 1, as claimed by Mr. Junge, but more nearly 3 to 2. To account for the apparent disregard of even this considerable saving, it is necessary to realize the conditions of blast furnace operations, a thing which power experts have seldom been able to do. It is safe to say that there is no apparatus in which the capital invested and value of output are both so high, as in the blast furnace. There is therefore a very heavy fixed charge of labor, interest, depreciation and other factors, amounting to from $1.50 to $2.50 per ton of iron produced, which goes on just the same whether the furnace is in operation or not. In many cases, furthermore, a steel works is an adjunct to the blast furnace immediately dependent upon it for operation, having a still larger fixed charge against its output. A suspension of operations at a blast furnace, therefore, means not only a loss of profit on iron not made, but also the loss of this fixed charge, the result being that the machinery and the furnace must be reliable in the first, second and third places and economical in the fourth. Any attempt to regard the blast furnace as the adjunct to the power plant may be an economical question but is commercially foredoomed to failure."

Mr. Johnson then gave an instance of a plant using gas engines, in furnaces which had begun to show signs of distress, being kept in operation in order to keep the power plant running, and which resulted in a shutdown for repairs requiring ten days and a money loss of nearly $100,000. This may be taken as a typical case of the possible occurrences at a plant with gas driven belting engines, which, while it might not be of frequent occurrence, would be sufficiently expensive, in every sense, to compensate for its rarity. The benefits, on the other hand, which are to be derived from gas driven belting engines through the utilization of surplus power are to be obtained only in a slightly reduced degree by the use of good steam machinery.

George J. Rathbun took issue with

Mr. Junge on the statement that the matter of over-load capacity in gas engines cannot be overcome. He presented some figures and curves to prove that this difficulty was not inherent in a cycle and that it might at some future date be eliminated.

Fuel Testing Results.

Mr. Fernald presented results obtained by him on fuels tested at the gas producer division of the United States Geological Survey fuel testing plant at St. Louis. Sixty-four tests were made and the results were plotted, the curves being shown by means of lantern slides. Mr. Fernald was subjected to a severe cross-questioning by the members in relation to some points which were either incomplete or obscure. Certain questions were asked which Mr. Fernald was unable to answer on account of the investigation not having been carried far enough. Written discussions were also submitted by C. J. Atwater and A. J. Wood. The paper was discussed verbally by Mr. Mathot and C. E. Lucke. The latter stated that gas engines should be discussed in large sizes when considered for power purposes. The problem of steam vs. gas as a motive power, should be considered under five heads, as follows:

1, the possibility of using gas in various cycles vs. steam in its cycles. In this the gas engine was superior; 2, the minimum for carrying out the cycles; 3, the availability of fuel; 4, the adaptability of the engines for their work; 5, the cost of labor and operation. Of these the second was the most important. The steam engine had been developed through a period of two hundred years and was not yet finished. The gas engine in its modern form was but fifteen or twenty years old. The gas engine manufacturers had made one style of engine and expected it to work under any and all conditions and most of the boilers were able to do this. The discussion was then closed in order to permit the reading of the other papers scheduled for this session.

Gas Producer Power Plant.

J. R. Bibbins' paper on a "Gas Producer Power Plant" was then read by title by the secretary.

The specific purpose of this paper is to present as conclusively as possible a demonstration of the fact that the gas power plant is a thoroughly practical form of motor power equipment; that it is reliable in operation, responsive to fluctuating demand, fairly simple to operate, and that it can deliver a unit of power with higher fuel efficiency and lower cost than the average steam plant of commensurate size. The plant under discussion is only 450 kilowatts, in capacity with three generating units operating on a 24-hour fluctuating industrial load. It is run entirely by producer gas made from a very ordinary grade of bituminous coal.

Following Mr. Bibbins' paper, the secretary presented Hans Holzwarth's paper on "Steam Turbine Characteristics." This is a highly mathematical paper which discusses whether there are characteristics for steam turbines similar to those given by the indicator card for reciprocating engines. The author gives a number of examples showing the influence of upon the output and economy of the turbine and draws conclusions from the working out of these examples. This paper was discussed by Captain Sankey, who also gave some samples from modern practice.

Boiler Problems Discussed.

A. Bement's paper on, "A Steam Boiler and Setting" was widely discussed. This paper shows a design for a water tube boiler arranged so that the gases flow across the tube surface of the boiler in five passes rather than in three as commonly used, the object being to utilize the entire tube surface of the boiler. The important feature effecting smokeless condition is the use of refractory tiles encircling the lower row of the tubes of the boiler, forming the equivalent of an arch over the fire, which extends nearly to the back of the boiler, so that the gases from the fire pass under this tile roof construction, and enter among the tube surfaces of the boiler at the back end rather than at the front, their exit from the boiler being at the front end. The suggestion prefers the use of a chain grate stoker in connection with the apparatus, and when so equipped, the author designates the plant as being smokeproof, although other forms of stokers may be used to advantage.

L. P. Breckenridge commented on the fact that boiler furnaces must usually be changed by the owner in order to meet the demands of smoke ordnances or to increase the economy. He stated that the builder who would put a boiler and furnace which would burn bituminous coal smokelessly on the market, and with an efficiency of even seventy-five degrees, would be doing a great service to the purchaser of small, or medium-sized power plants. W. D. Ennis gave the result of some tests made in California with oil fuel, in which an efficiency of eighty per cent was obtained. This high efficiency was obtained by placing retarders on a four inch type of Babcock & Wilcox boiler. Dr. Wm. Kent stated that Mr. Bement's proposed setting was a long step in the direction of smokeless competition and of maximum absorption of heat at the heating surface of the boiler. A trouble with nearly all furnaces designed for the suppression of smoke is that they do not make any provision for increased air supply at times when the boiler is driven beyond its normal rate, or rather when the furnace is driven beyond the rate at which no smoke will escape from the chimney. He also commented on balanced draught and later on in the discussion protested emphatically against the admission of some figures submitted in the discussion by Embury McLean regarding some tests made with his system of balanced draught. Mr. McLean's discussion presented a system in which a damper and fan were interconnected so that zero pressure was maintained in the furnace at all times. Mr. McLean presented a great number of tests to prove the saving effected by this device, and it was against the admission of these tests that Dr. Kent protested.

W. L. Abbott stated that three requirements were essential for an ideal plant using Illinois and Indiana coal as follows:

(1) a water tube boiler provided with an automatic strainer which will gradually and continuously induce fresh fuel at one end of the furnace and discharge the refuse from the other end. (2) a tile roof above the furnace extending well back to the fuel bed, which will compel the gases distilled from the fresh fuel to travel back over the hot fire and back into a combustion chamber above permitting it to enter among the boiler tubes. (3) an arrangement of baffles which will cause the gases to flow with velocity through every portion of the gas space of the boiler. The paper was also discussed by J. M. Whiteham, who also commented on the system of balanced draught outlined by Embury McLean, and by J. C. Parker, who commended Mr. Bement's furnace. W. H. Bryan stated that the plan of baffling was not new, the records of the patent office showing innumerable designs of this kind at the present time. He objected to the design in that it necessitated increased draught which is not available in an ordinary plant, and he also criticised the additional complications introduced, such as cleaning doors, cleaning on the side, etc. Prof. Jacobus

also spoke mainly along the lines indicated by Mr. Bryan.

High Duty Air Compression.

Prof. O. P. Hood's paper on "High Duty Air Compressor" was then presented. The object of this paper is to put on record the results of a test of a high duty engine used in connection with an air compressor. The engine is quadruple expansion, uses steam at 250 pounds pressure and is provided with a feed water heating system which obtains a large credit for heat returned to the boiler.

In this engine the weight of steam sent to each of the four successive cylinders is a continually decreasing amount due to steam withdrawn during expansion for purposes of feed water heating, and the paper indicates a method of discovering the several subtractions without interfering with the action of the peculiar feed heating system. It was discussed by W. L. Saunders, Sanford A. Moss, W. Y. Lewis, Jr., Storm Bull, and others. Mr. Lewis regretted that the paper treated only of thermodynamics because, as everything in engineering was a question of dollars and cents, it would have been of much more interest to the profession, if details of the capital and expenditure necessary to attain such high thermal efficiency had been given.

"The Steam Plant of the White Motor Car" was then described in a paper by Prof. R. C. Carpenter. The paper gives a detailed description of a series of tests made on an engine and boiler of a 1907 car, and also results of a test made by Prof. Benjamin on an engine and boiler of a 1904 car. The author believes the paper is of considerable importance in pointing out a practical method of using steam of high pressure and of a high degree of super-heat, and is of the opinion that if the steam engine is to maintain its supremacy as a power producer, in competition with internal combustion engines, that improvement must be along the line of producing and using steam with high pressures and a higher degree of super-heat.

The Skilled Workman Problem.

This concluded the proceedings of the Wednesday afternoon session. As the United States government, through the war department, had tendered the society an invitation to visit the gun-proving grounds at Sandy Hook and Fort Hancock on Friday, and as the trip would require the entire day, the session assigned for Friday morning was carried forward to Wednesday evening. The meeting was called to order at 8:30 and the first paper presented was that of M. W. Alexander, entitled "A Plan to Provide Skilled Workmen."

The plan outlined on this paper deals with the manufacturer's side of the problem and describes a modern apprenticeship system, succesfully developed by the General Electric Co. at West Lynn, Mass. Apprentices are kept in the training room for about two years under expert instruction on commercial work, especially selected from the whole work in the factory. They are then sent into the factory department for the remaining two years of the course in order to acquire greater speed and skill on a larger variety of work.

A special school is conducted, in connection with the apprenticeship work, in which the elementary and some of the more advanced sciences are taught in a practical way in their application to every day factory life.

This paper endeavors to prove the feasibility of establishing similar training rooms and lecture courses for smaller concerns; a common training room for several small factories in a locality; and finally, an independent and self-sustaining training room—a new and practical trade school for the benefit of the industries of a community. The paper then considers the other element in providing for a constant supply of skilled workmen, i. e., the possibilities of making skilled specialists, and eventually of developing unskilled workmen into skilled artisans. It suggests that the factory be utilized for this purpose during evening hours. The training room is shown to be especially suited for this industrial educational extension work.

This paper also evoked considerable discussion. Milton P. Higgins questioned what was to happen the boys who were just below the grade which fitted them for a professional life? These boys should learn trades, and the outlook for the boys under conditions existing in shops today is not bright. Industrial education consists of two parts, skill and schooling. Each is as real and vital, as mind and body, and each of equal importance. The shop training is the vital part, requiring attention in industrial efficiency and the problem is simplified when attention is concentrated upon this part. To do this it is necessary to have a training shop, with the one object of teaching a trade. Mr. Higgins condemned the tendency in some technical schools to demean manual labor by calling machine shop work, "machine laboratory exercise" and the foundry, "the molding laboratory." Mechanical skill is something to be proud of. Skill is the counterpart of knowledge and the two combined constitute the creative power of a people.

President Taylor thought that the time would come when the labor unions would realize that the true and permanent road to prosperity and high wages would lie in so educating themselves as to be able and willing to do more work in return for larger pay, rather than in fighting to do less work for the same pay or the same work for larger pay. The employer, however, needs as much enlightenment on this subject as do the working class, and should be brought to realize that personal interest, as well as duty, require the education of the employes so as to fit them for a higher wage, and then establishing such conditions as will enable them to get it.

H. K. Hathaway thought that there was one serious fault in the system described by Mr. Alexander, that is, that one man and two assistants are expected to instruct and maintain discipline among one hundred and twenty-five boys, to interview and select new recruits, to study carefully the mental and moral make-up of each boy as well as his aptitude for his trade, and to follow up the progress of many other boys who are completing their course in a factory department. This is made possible by utilizing most of the apprentices themselves for assistant instructors, and is, in itself, an indication that there is a shortage of men in charge. The training shop plan was entirely out of the question for the average, small manufacturing plant, and their solution must come from another source. Mr. Hathaway considered that Mr. Taylor's plan of functional foremanship offered the best solution and related his experience in installing this plan in a shop with good results. Another gentleman stated that Mr. Alexander's plan aims to meet the demand for a new type of man; to develop men who are able to reason from cause to effect, and can adapt themselves to new conditions as they occur. He stated that employers were short-sighted who did not train men for the future. The idea presented in Mr. Alexander's paper is different from former plans, in that it instructs men to use their brains as well as their fingers. W. B. Burlingame stated that at the Brown & Sharpe plant the apprentices were mixed with the men and were

expected to assimilate knowledge from them. He was much in favor of the boys instructing each other. He endorsed the plan used by the General Electric Co., and stated that the apprenticeship system should be pushed and developed. H. F. J. Porter stated that education alone would not make organization and it was necessary to keep employes with the firm after they were instructed, and gave instances to bear out his assertion. This closed the discussion on Mr. Alexander's paper, and the convention then proceeded to the consideration of E. P. Coleman's paper entitled, "Flow of Liquids in Venturi Tubes."

The object of the experiments described in this paper was to prove (or disprove) the accuracy of the Venturi tube as a meter for gases and vapors at a comparatively low throat velocity. The Pitot tube was selected as an instrument for comparison on account of its proven accuracy and its ready availability.

In the experiments, the theoretical flow of air through the Venturi meter is apparently in agreement with the flow as derived from Pitot tube observations, within the limits of reasonable errors of observation and within the range of velocities employed. In the experiments with dry saturated stream, the theoretical flow is in agreement with that obtained by weighing, but the scope of the experiments was not sufficient to prove accuracy in general.

This paper was discussed by R. C. Carpenter, Sanford A. Moss and A. Herschel.

A paper on the "Ventilation of the Boston Subway" by H. A. Carson was next taken up, and was discussed by C. S. Churchill, L. H. Woodbridge, W. Clifford and Francis Fox.

The ventilating system for 4 1-3 miles of the Boston subway is based on the admission of fresh air at stations and portals and the withdrawal of so-called soiled air at stations by exhaust fans at points about half-way between. The air can be entirely renewed four times or more per hour.

On account of the numerous discussions presented for each paper, the meeting was very protracted and after discussion of Mr. Carson's paper had been concluded, President Taylor announced that as the hour was extremely late the remaining papers scheduled for this session would be carried over to the Thursday morning session.

Thursday Morning Session.

The first business taken up at the Thursday morning session was the presentation and discussion of the papers carried over from the Wednesday evening session. A. J. Hershmann's paper on "Tests of an Elevator Plant" was read and passed without discussion. This was followed by a paper by Prof. W. B. Gregory on "Test of a Rotary Pump." A. M. Lockett and R. C. Carpenter discussed this paper, the latter pointing out possible errors in the test and conclusions. Prof. W. F. Durand's paper on an "Improved Transmission Dynamometer" was then read and discussed by Prof. R. C. Carpenter, who presented a design of a dynamometer used for the determination of the efficiency and friction of bicycles. J. J. Flather stated that the machine described by Prof. Durand was a modification of the older form of dynamometer.

Roof Construction Discussed.

Two papers on "Saw-Tooth Roof Construction" by F. S. Hinds and K. C. Richmond, respectively, were then taken up.

The principle in the so-called saw tooth form of skylight described by Mr. Hinds is the focusing of a strong north light upon the work in process. The English design is in the true form of saw-tooth; the American, in the modified form, or semi-saw-tooth flat roof design. The English design was Americanized by the writer to meet the conditions of this climate, and provides a narrow, flat roof between each skylight, varying in width from 24 to 48 inches.

Saw-teeth skylights are adapted to factory buildings, machine shops, and all kinds of industrial plants where better lighting is desired than can be obtained from windows. It is superseding the common monitor roof, and is especially adapted to erecting rooms and craneways. It solves the problem of wide one-story flat roof machine shops and factories. As it admits of a greater width and less length, hence a more compact arrangement of departments.

Mr. Richmond said that saw-tooth skylight is a form of roof lighting designed to admit light from the sky without allowing the direct rays of the sun to enter. It is especially effective in rooms of large area where a great deal of diffused light is desirable. The angle of the window should depend upon the latitude and design of window trimming. Windows do not necessarily face the north to give the best results. The proper proportioning of saw-tooth light is important without wasting money in their erection. To obtain the best results, there should be no intervals between the saw teeth.

Walter B. Snow stated that ventilators were of little use in this type of roof, and that to obtain any benefit, positive acting fans are necessary.

A. E. Brown's paper on "Ferroinclave Roof Construction" describes a roof made of ferroinclave sheets weighing about 15 pounds to the square foot, which was invented by the author for use on the roofs of the Brown Hoisting Machinery Co., Cleveland. The strength of ferroinclave sheets with different thicknesses of cement on the upper side, and a uniform thickness on the under side, varies from 300 to 3,000 pounds per square foot, uniform breaking load, on a span of 4 feet 10½ inches. E. N. Hunting, in discussing this paper, gave an outline of modern requirements for a fire-proof roof, the more important of which are as follows: The roof shall not weigh over 25 pounds per square foot, the basis of the fire-proofing material being Portland cement concrete suitably reinforced by steel plates nearer the lower side of the slab. No wood frame should be necessary in this construction and its cost should not exceed 20 cents per square foot. The reinforcing material should be of a nature that the concrete keys into it, and the latter should not crack due to expansion and contraction. He concludes that the ferroinclave roof does not fulfill all of these conditions and presented the "herringbone" truss lath as a substitute. The oral discussion brought out remarks concerning the rapid corrosion of iron or steel in roofs of this kind, also a consideration of the relative merits of vertical or inclined sash in saw-tooth roofs. The speaker strongly favored the inclined glass whenever possible because of the superiority of the light falling directly from above.

The Metric System.

"Weights and Measures" by Henry R. Towne was the next paper considered. It advocates the referring of the question of improving our system of weights and measures to a technical commission appointed by the president of the United States and whose report shall form a basis for permanent legislation. The paper is an argument against the adoption of the metric system and describes the confusion existing in countries which are using the metric system, due to the persistence of the old standards. S. S. Dale in a long discussion opposed the appointment of a commission and

Samuel Webber recommended minor changes in our present measures of capacity so as to make the various units of capacity, weight, length, etc., bear a more simple relation to each other than they now do. If this should be done the metric system would have no advantages over the English system and would possess many disadvantages in comparison with it. Oberlin Smith thought that while the metric system possessed many advantages, the amount of work which would be required to change to it would be terrific, owing to the persistence of the old units in connection with everything in existence at the present time. He related the advantages of a system of numbers using 16 instead of 10 as a base and predicted the ultimate adoption of such a system. He also advocated the retention of the inch as a unit, but the simplification of some of the other units of measurement. George Schumann favored the adoption of the metric system and ridiculed the idea of any confusion due to a change from the present system of weights and measures. H. H. Suplee gave an outline of the French law relating to the metric system and F. A. Halsey offered violent objection to the appointment of a commission advocated by Mr. Towne, whose only possible object could be to introduce changes in the present system. Dr. William Kent advocated a few minor changes in the present standards, so as to make them commensurable with one another, and also the abandonment of a few useless units.

W. B. Burlingame, of Brown & Sharpe, felt that the commission proposed should be accepted as judicial rather than partisan, and that if the consideration were carried on fairly no one need fear the results. He urged that something be done to bring the English and American systems especially in regard to liquid measures, to a uniform basis.

Refrigerating Machine Code.

Prof. D. S. Jacobus on behalf of the committee on code of rules for testing refrigerating machines presented a short report which, it was announced, would be distributed to members through the usual channels. The society was requested to respond with a thorough discussion.

A vote of thanks was tendered in the usual form to the corporations and organizations which had extended invitations to the members during the meeting.

President Taylor then introduced the new president formally to the assembly. President Hutton said with his accustomed grace that if the society wished to confer a token of honor and affection upon one beloved in an unusual degree, no gift could be more grateful or acceptable than that of the highest office in the association itself. As his first official act he spoke the words adjourning the meeting—precisely on schedule time.

The final paper of the session was entitled "Mechanical Engineering Index," by Professors W. W. Bird and A. L. Smith. The index described in the paper consists of a series of tab cards, one after every subject connected with mechanical engineering, arranged in alphabetical order so that any given topic is easily found. It has been devised and is in use at the Worcester Polytechnic Institute, and is recommended by the professors in the department of mechanical engineering. Owing to the lack of time the discussions during this session were cut very short, the five-minute rule being rigidly enforced. After the presentation of Prof. Bird's paper the professional sessions were brought to a close, the remainder of the convention being devoted to excursions and social features provided for.

Incidents of the Meeting.

The new engineering building of the three societies, mining, mechanical and electrical engineers, was open for inspection between the hours of 3 to 6 o'clock p. m. on Wednesday afternoon. The building is almost finished but the furniture and some fittings have yet to be installed. It is a magnificent structure and the engineers and architects who have planned it deserve the greatest credit. It is a splendid home for the three societies, and it is the greatest of pities that the American Society of Civil Engineers did not vote to become joint owners of it with the other three societies and thereby unify the whole American engineering profession. A number of invitations were received for the entertainment of the members and guests, among them being one from the New York Central railroad to inspect the new power station at Port Morris, which is to furnish electricity for the operation of trains between the Grand Central station and Croton, N. Y. A special train conveyed several hundred members and guests to the station. It is, of course, a thoroughly modern power station, substantially built of brick, with capacious docks on the East river for receiving coal. The boiler house is two story, each story with two rows of Babcock & Wilcox boilers and a coal storage bin above the boilers. The engine house at present contains four of the largest size Curtis turbines, each with its condenser and a steam-driven circulating and air pumps. Each turbine drives a 7500-kilowatt alternator, furnishing a current of 11,000 volts, which is converted at the several substations along the line into direct current at 700-volts.

The reception was held at Sherrys on Thursday evening, and was the usual brilliant affair. Dancing was indulged in by many couples until an early hour in the morning.

Probably the most unusual entertainment ever furnished an engineering society, was the excursion to the gun-proving grounds at Sandy Hook and Fort Hancock, forming one of the defenses of the New York harbor. The society being the guest of the war department, Secretary Taft detailed a large number of ordnance officers to accompany the members through the various batteries and give detailed explanations of the workings of the several systems of defense employed, including disappearing guns, mortar batteries, submarine mines, small guns for protecting the mines, the fire control system, search lights, etc. The whole constitutes the most perfect system of sea-coast defense yet designed, and it forms an impregnable barrier against the entrance of any hostile fleet. The proving ground contained samples of all the different kinds of guns used both in the army and navy. Service charges were fired from a ten-inch gun and a six-inch gun and several smaller guns, including a "pom-pom" gun of the style used in the Boer war, and capable of firing 400 one-pound shells per minute. A most interesting event was the simultaneous firing of four 12-inch mortars from one of the concealed pits in the fortress. The method of determining with great accuracy the velocity of projectiles, was explained to the visitors by General Crozier, chief of the ordnance department, and his aides. The society was welcomed by Gen. Murray, and Gen. Crozier.

The excursion was one of the most instructive ever taken by the society, and was an object lesson of what is being done by the engineer and ordnance corps of the United States army. It is safe to say that it made a deep impression on every one of the seven hundred persons present. There were seven members of the party who were sorely disappointed because they did not have an opportunity to be impressed. They were two Germans, one Englishman, one Frenchman, one Japanese, one Canadian and one Scotchman, and under the laws of the United States aliens can not be admitted to fortifications of the nation. Hence they were entertained as well as detained in the library, greatly to their disgust, although the exclusion was managed with much tact.

OPEN - HEARTH STEEL CASTINGS.—XI.

Heat - Treatment and Annealing of Steel Castings.

By W. M. Carr.

Under this heading it is not proposed to advance arguments as to whether or not steel castings should be annealed since some opinions are held that it is not necessary with certain compositions chemically. Rather the remarks herein will be an explanation of what occurs when cast steel is given various heat treatments.

From a theoretical standpoint all castings (steel) should be annealed. Practically it is difficult to properly undertake the operation, particularly when the tonnage may be large as then the process presents commercial considerations If specifications are rigid it is important to carefully anneal, and it is at this point that the nub of the question arises. To keep the output parallel with deliveries would involve an extensive array of annealing furnaces, and since most foundries are without capacity to anneal their entire output, an attempt to treat all castings produced would result in a slighting of the necessary care to get the best out of the process. It is better not to anneal at all than carry it out without each casting getting a proper treatment under skillful conditions. Annealing is a waste of time and money without this proper and skillful care in the work.

In general most metallurgists view heat treatment as primarily a method to equalize or lessen strains and stresses set up in a casting during cooling in the mold especially when the shape may be complicated by intricate parts or light and heavy sections combined. True a re-heating will tend to adjust these strains but really heat-treatment is a method to procure in a casting the best possible conditions in the internal structure consistent with the physical properties.

To understand what is involved in the more advanced practice necessitates a consideration of the relation between structure, heat-treatment and physical conditions.

The internal structure or crystalline formation depends mainly upon the casting temperature and the rate of cooling from that temperature. It is known that the physical properties reflect in a large degree the size, shape and character of the crystals formed in steel castings. If a freshly fractured surface of a steel casting cooled normally from casting temperature be examined, to the eye the grain will be coarse and large. If the same casting be re-heated to a much lower temperature than that at which it was cast, say a bright red, cooled and again fractured it will be noticed that grains or crystals are much smaller and closer than in the original piece. It will also be noticed that after the re-heating it was more difficult to produce fracture than in the first instance, the metal seemed tougher. These facts give but a hint of the potent changes set up.

The refinement of the crystals when subjected to varying ranges of temperature and rates of cooling offer interesting features which to fully appreciate, requires a delving into their details by means of a miscroscope. The microscopic examination of metals has developed a comparatively new science known as "Metallography" and with it a number of terms which apply to crystalline formations in metals not visible to the unaided eye.

Before going into a recounting of the constituents visible through the microscope and formed in cast steel, the changes produced by heat treatment upon the physical properties will be considered.

If a piece of cast steel be allowed to cool freely from a casting temperature there will be a grain or crystal growth proceeding to a certain point when the growth ceases. The metal in that condition will not possess its maximum ductility expressed as elongation and contraction of area. It will be more or less brittle, depending upon the carbon content. If that same piece of steel be re-heated to or about the point at which the grain growth stopped and allowed to cool slowly, the coarse grain developed during the first cooling will be greatly modified, broken up or obliterated and replaced by a finer grain than it had originally. In this new condition the ductility will be greatly improved; the metal will be tougher and better fitted for service conditions in any case than without a re-heating. Such a re-heating is properly speaking "annealing." The object then in annealing is to so affect the grains or crystals as to develop the maximum degree of toughness that a casting of a given composition is capable of developing.

By referring to Fig. 1, an idea will be suggested as to the changes taking place in structure by heating. The examination was made on a piece of 0.25 carbon steel possessing a coarse structure common to steel of that composition cooled normally from casting temperature. The arrows indicate the temperature to which the specimens were heated and immediately allowed to cool. The temperature was obtained in an electrical muffle furnace and measured by a Le Chatelier pyrometer. The structures were noted microscopically. The range

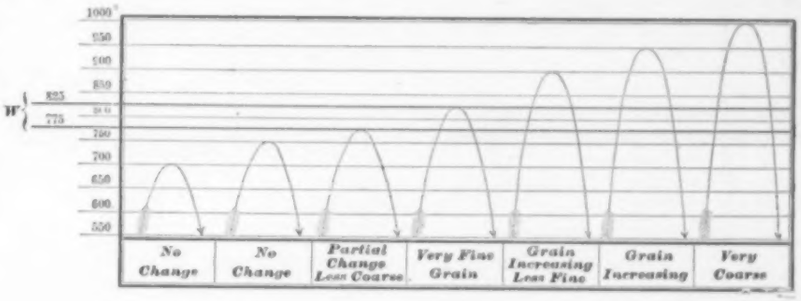


Fig. 1.—Showing Structural Changes.

"W" refers to recalescence or refining temperature. It is that range thermometrically at which all coarse crystallization acquired in cooling from temperatures above "W" and near the melting point is changed and replaced with a finer structure or as fine as it is possible to get in an ordinary piece of cast steel. A re-heating below "W" does not accomplish anything in cast steel. A re-heating greatly above "W" causes the grain to again grow after it had been refined while the piece was passing through the recalescence period.

To grain-refine a piece of cast steel it is necessary to pass through and slightly above "W," and after that point has been reached nothing is to be gained by a prolonged or higher heating. That is to say, if the piece is heated throughout at the needful refining temperature the fire may be drawn or if the shape will permit it, it can be air-cooled immediately. In doing so all stresses will be minimized and no matter what the previous structure may have been, the irregularities of original stress and grain will be removed by heating the mass to a uniform color (slightly above

"W") and then allowing it to cool uniformly.

The equation of time for grain refinement depends largely upon the size and shape of the piece; a wire may be brought to the right heat in a few moments. Then it should be withdrawn because a longer heating is needless. A cube 8 inches or more in section might take several hours to refine it and heat it through, but as soon as uniformly heated and refined there is absolutely nothing to be gained by heating further. Longer heating would result in grain enlargement, a decrease in ductility, toughness, a heavy scaling of the piece and a superficial de-carbonization as in malleableizing if "W" is greatly exceeded. To sum up the question of temperature and its effect upon grain size Prof. Sauveur says:

(1) "When a piece of steel, hardened or unhardened, is heated to the temperature 'W,' all previous crystallization however coarse or however distorted by cold working, is obliterated and replaced by the finest structure which the metal is capable of assuming."

(2) "The higher the temperature above 'W' from which the steel is allowed to cool undisturbedly the larger grains."

(3) "The slower the cooling from a temperature above 'W' the larger the grains." "The Metallographist," Vol. 2, pp. 265 x 266.

So much for temperature and corresponding grain growths. The matter in Table 1 is selected from averages obtained in researches conducted some four years ago by the writer upon the effect of grain size as affecting the physical properties of cast-steel:

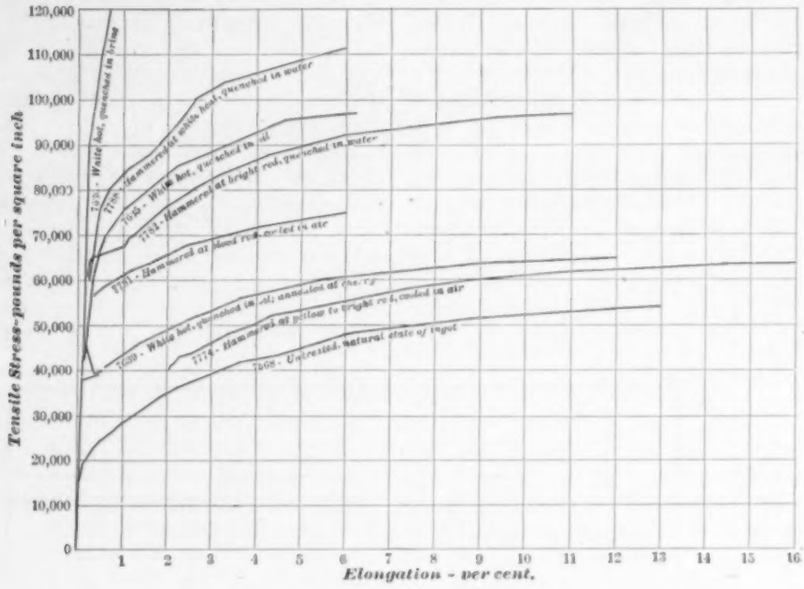


FIG. 2.—RECORD OF GOVERNMENT TESTS.

TABLE 1.

Tensile strength, pounds sq. in.	Elongation, per cent, in.	Contraction, per cent, in.	Treatment.
			SERIES I.
80385	13.26	16.2	Metal as cast.
78767	27.20	40.4	Heated to "W."
79422	14.80	15.3	Greatly above "W."
			SERIES II.
77779	26.5	28.5	Metal as cast.
74504	25.0	48.8	Heated to 830 degrees, quenched, reheated to 750 and air cooled
78792	25.0	34.3	Heated to 815 degrees one hour and air cooled.
74058	25.7	31.	Heated 24 hours at 850 degrees. Cooled in furnace. Four hours in heating. Eleven hours cooling.
73376	24.2	26.7	Heated 36 hours between 850 to 900 degrees. Heating up 3 hours 15 min.. Cooling down 9:45.
90400	2.5	3.	Heated to 1200 degrees and quenched.

In the foregoing Series I are the averages of a number of bars from the one heat of steel and Series II from another heat. A study of the figures will readily show what can be done in arriving at different physical properties by varying the heat-treatment. Reference to diagram Fig. 2, which is a record of some extreme tests carried out by the U. S. government at Watertown arsenal, will still further enlighten one as to the contrasting behavior physically affected by heat treatment. These experiments in conjunction with others on record show, that, unless the heat-treatment is a constant and other conditions normal in steel casting practice, it is not possible to readily forecast, by means of formulas, the physical properties taking into account the chemical composition.

THE PRESCOTT PATENTS.

The Fred. M. Prescott Steam Pump Co. is the owner of several patents upon triple expansion and multiple expansion engines, invented by Fred. M. Prescott, Milwaukee, Wis. These comprise U. S. patents No. 751997, dated Feb. 9, 1904; No. 751996, dated Feb. 9, 1904; No. 751995, dated Feb. 9, 1904; No. 719367, dated January 27, 1903; No. 719136, dated Jan. 27, 1903.

This company also owns several applications pending in the patent office. upon which patents are shortly expected to issue, covering other features in triple expansion and multiple expansion engines. These patents are considered to cover all available forms of constructions including arrangements of piston rods and steam cylinders, which provide the one great departure in pumps and engines of this class, i. e., accessibility of its parts, and the ability to examine or remove any of its pistons or rods without tearing down or disturbing the steam cylinders or any of the heavier parts of the engine. Without these distinctive features, the so-called triple expansion pump loses entirely its commercial utility.

The Prescott patents are the product of much study and many years of experience in the development of pumping engines of these types, and adapting them to various local conditions, on the part of Mr. Prescott, and are features of the utmost value to the company. It is therefore, necessary for it to protect its rights and the exclusive ownership and control of these patents, to the utmost.

It is understood that certain infringements have been offered to the trade, and in all courtesy the company desires to notify any would-be purchasers of the existence of its rights, and that it will be compelled to uphold and defend them wherever infringed.

An interest in the Western Machine Tool Co., Holland, Mich., has been purchased by Edgar W. Cleveland, for the past four years with the Baush Machine Tool Works, Springfield, Mass.

PROPERTIES OF THE DIAMOND STATE STEEL CO.

Details in connection with the plant and effects of the Diamond State Steel Co., Wilmington, Del., which is to be sold Dec. 18, is scheduled below, listing the various properties in addition to fifty-six acres of land and wharves:

Steel Plant. — The steel plant has been built complete since 1899. It consists of five 50-ton open-hearth furnaces, with suitable heating furnaces, a 34-inch blooming mill, driven by a direct-connected Tod engine, all equipped with complete electric, hydraulic, compressed air and steam-power outfit, Morgan cranes, heavy shears, etc., electrically driven. All the buildings of the steel plant are constructed of steel. Everything appertaining to the steel plant is of late and improved design.

Finishing Mills.—The finishing mills consist of seven trains of rolls, running in sizes from eight-inch to 18-inch diameter, with rolls to roll standard and many special sizes of steel and iron bars, splice bars, together with an assortment of angles, tees, channels and special bars, as well as tie plates.

Puddle Iron Department.—This department has a complete outfit of puddling furnaces and puddle mills for the production of puddle iron bars and billets.

Spike Department.—This is equipped with automatic and hand machines for the manufacture of railroad track, boat and wharf spikes.

Rivet Department.—This department is fitted with machinery for the manufacture of boiler, bridge, boat and tank rivets.

Track Bolt Department.—This department is equipped with machines for the manufacture for all sizes of railroad track bolts, either with cut or rolled thread, cold and hot punched nuts.

Machine Bolt and Nut Department. —This department is equipped with a number of machines for the manufacture of machine bolts, rods, hot and cold punched nuts, carriage bolts and other special bolts and nuts.

Forge Department.—This is equipped with steam and hydraulic hammers, benders, furnaces, etc., for the manufacture of forgings and other iron work suitable for use in the construction of cars, buildings, bridges, etc.

Foundry Department.—This is fitted for the manufacture of a varied line of iron castings, such as are used in machine and mill use, building, bridge and other work. It is also equipped with a brass foundry for the manufacture of brass and composition castings of various kinds.

Galvanizing Department.—This is fitted for the galvanizing of spikes, bolts, rods, bars and electrical equipments, such as cross-arm braces, etc.

Horseshoe Department.—This is fully equipped with benders, pressers and other machinery for the manufacture of horse and mule shoes of steel and iron.

Machine Shop.—This is thoroughly equipped with modern lathes, drills and other tools for the manufacture of and repair of machinery, etc.

Yard Department. — The yards of the company are equipped with terminal tracks for the convenient handling, discharging and loading of incoming or outgoing freights, either by rail or water.

A METALLIC CORE-VENT.

All foundrymen know that there is a very large class of intricate cores which require both rodding and venting and frequently solid rods interfere seriously with the venting of such cores. To overcome this difficulty, H. C. Caldwell, of Philadelphia, has invented a metallic core-vent which is now manufactured by the Metal Core-Vent Mfg. Co., with offices at 416 Mutual Life building, Buffalo, N. Y.

FIG. 1.—METALLIC CORE-VENT.

This vent consists essentially of a metallic ribbon twisted into a tube, as shown in one of the accompanying illustrations.

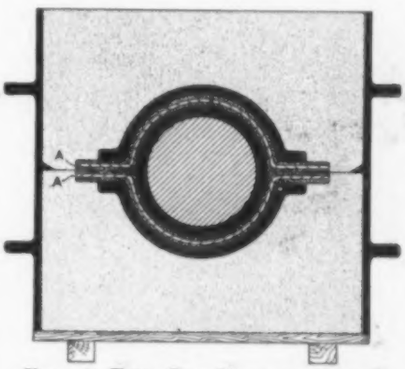


FIG. 2.—THE CORE-VENT IN PLACE.

The twisting is close enough so that the edges of the ribbon have a bearing along the seams in such a manner as to give great stiffness to the vent. The seams, however, are sufficiently open to permit the gases to flow into the center tube. For straight work this core-vent forms both a rod and a vent or passage. For curved work the vent may be bent to any desired shape, as for instance, in the two halves of the jacket core shown in Fig. 2 the vents have been bent and brought out through core prints at the side, as shown at AA. There are a great many places where this style of vent will be found exceedingly useful. When the vent is bent the seams will open somewhat and in order to prevent the sand entering, these open joints are filled with any kind of wax, such as paraffine, beeswax, etc. The wax melts out during the baking of the core and thus assures a free and open vent, while the metal still gives stiffness to the core. One of the important points claimed for this core-vent is that it is not as liable to buckle or bend cores on account of expansion of the metal, as is the case with solid rods.

These core vents can also be used over and over again in cases where they can be removed as the core is taken out.

It is also claimed that a much cheaper core mixture can be used in many cases, as the substitution of the combined vent and rod makes a stiffer core than can be obtained even with an oil sand core under the old system of construction.

CASSATT ON ELECTRIC POWER.

President Cassatt, of the Pennsylvania railroad, in protesting against the order of the commissioners of the District of Columbia to substitute electric motors for steam locomotives within the District when the new union station is to be used, says: "The use of electric motors at terminals is only in the experimental stage, but it is very certain that the shifting and making up of trains cannot be done as expeditiously by this method." Electric motive power could not be provided by the time the station is opened, Mr. Cassatt further declares, and even if it were adopted would incommode the traveling public by reason of the extra stop to change from steam to electric power at the border of the district.

The Warren City Boiler Works, Warren, O., is making extensive additions to its plant and will greatly increase its capacity.

A SPECIAL ELECTRIC TRAVELING CRANE.

Pawling & Harnischfeger, Milwaukee, have recently designed and completed for the Chicago, Milwaukee & St. Paul railway three special one-ton, three-motor electric traveling cranes for use in the new wheel foundry of that railroad. They are equipped with two ½-ton fixed hoists, and are designed to serve the pits for annealing chilled cast iron car wheels and to meet the requirements of the service as conditions were presented. The crane bridges are constructed of channels riveted to cross channels at the end in which the truck axle boxes are supported. This construction is very clearly shown in the illustration, Fig. 1. The truck wheels are keyed to cross shafts on both sides of the bridge, the wheels being chilled and ground true. The bridge is driven by a motor fastened to the side of the bridge geared through two reductions to the cross shaft. The bridge foot brakes consist each of two hinged shoes enclosing a band wheel that is keyed to the intermediate shaft of the bridge drive. These shoes are operated by a toggle connection to the foot levers at the bottom of the cage by means of reach pipes. The bridges are thus brought under the immediate control of the operator without the necessity of reversing the motor to stop the drifting of the bridge when it is desired to bring the crane to rest at any designated point.

The operator's cage is suspended from the bridge at its middle point. It hangs about one foot from the floor, thus permitting the operator to travel with the work. A switchboard is fastened to the cage by means of which current is distributed to the motors. Two 1,000 pound fixed hoists are attached to the under side of the bridge, so located that the hoist ropes and bottom blocks hang directly over the center line of pits served by the crane. Each crane serves two rows of pits. The hoists are high speed, direct lift and independent of each other. One end of the drum shaft is supported by steel castings bolted to the bridge channels. These castings also form a base for attaching the gear cases that contain all the hoist gearing and mechanical brakes, thus providing a rigid and self-contained construction. To one side of the gear cases are fastened the hoisting motors, the armature shafts extending through to receive the electric motor brakes that are attached to the opposite side of the gear cases. Machine cut spur gearing is used throughout, and all bearings are bronze bushed. As the operator stands in the cage, the three controllers are within his reach, and when operating the tongs in the pits, he is able to guide them into the cored hole of the wheel to be lifted.

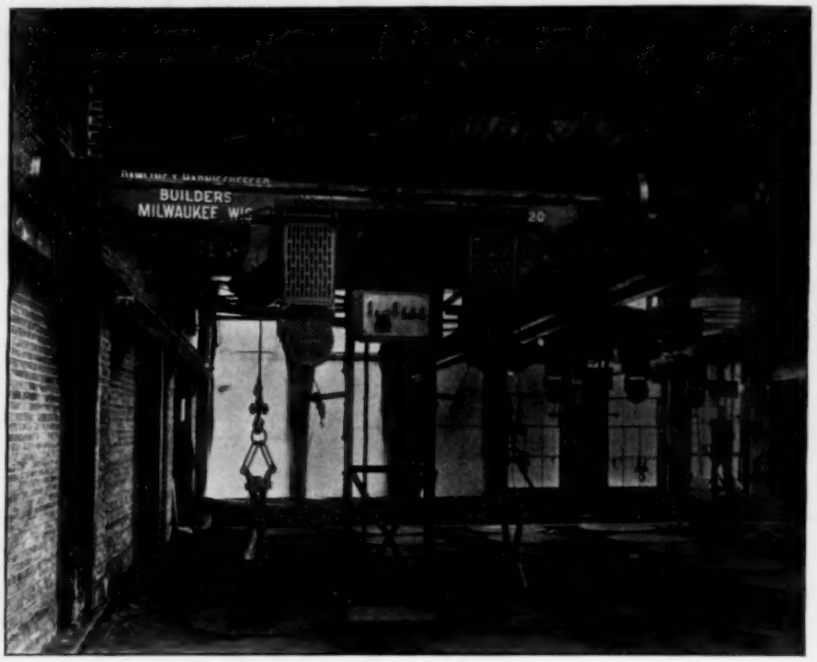


FIG. 1.—SHOWING CRANE CONSTRUCTION.

FIG. 2.—VIEW OF THE INSTALLATION.

The foundry which these cranes serve is equipped for turning out 600 car wheels per day. The cranes above described are only one of the many special features which have been introduced to facilitate the molding and handling of this output. The ovens are placed in a large pit with concrete walls surrounded with sand, thus preventing the radiation of the heat and allowing the wheels to cool slowly.

One More Furnace.—The LaBelle Iron Works, Steubenville, O., has made an appropriation for an additional 55-ton open-hearth furnace. This will make ten in all at the plant.

TAYLOR ON THE ART OF CUTTING METALS.[1]

There are three questions which must be answered each day in every machine shop by every machinist who is running a metal-cutting machine, such as a lathe, planer, drill press, milling machine, etc., namely:

(a) What tool shall I use? (b) what cutting speed shall I use? (c) what feed shall I use?

Problem Confined to Roughing Work.

The writer will confine himself almost exclusively to an attempted solution of this problem as it affects "roughing work;" i. e., the preparation of the forgings or casting for the final finishing cut, which is taken only in those cases where great accuracy or high finish is called for. Fine finishing cuts will not be dealt with. Our principal object will be to describe the fundamental laws and principles which will enable us to do "roughing work" in the shortest time, whether the cuts are light or heavy, whether the work is rigid or elastic and whether the machine tools are light and of small driving power or heavy and rigid with ample driving power.

In other words, our problem is to take the work and machines as we find them in a machine shop, and by properly changing the countershaft speeds, equipping the shop with tools of the best quality and shapes, and then making a slide rule for each machine to enable an intelligent mechanic with the aid of these slide rules to tell each workman how to do each piece of work in the quickest time.

Slide Rule Doubles Output.

It may seem strange to say that a slide rule enables a good mechanic to double the output of a machine which has been run, for example, for ten years by a first-class machinist having exceptional knowledge of and experience with his machine, and who has been using his best judgment. Yet, our observation shows that, on the average, this understates the fact.

To make the reason for this more clear it should be understood that the man with the aid of his slide rule is called upon to determine the effect which each of the twelve elements or variables given below has upon the choice of cutting speed and feed; and it will be evident that the mechanic, expert or mathematician does not live who, without the aid of a slide rule or its equivalent, can hold in his head these twelve variables and measure their joint effect upon the problem.

These twelve elements or variables are as follows:

(a) the quality of the metal which is to be cut; (b) the diameter of the work; (c) the depth of the cut; (d) the thickness of the shaving; (e) the elasticity of the work and of the tool; (f) the shape or contour of the cutting edge of the tool, together with its clearance and lip angles; (g) the chemical composition of the steel from which the tool is made, and the heat treatment of the tool; (h) whether a copious stream of water, or other cooling medium, is used on the tool; (j) the duration of the cut; i. e., the time which a tool must last under pressure of the shaving without being reground; (k) the pressure of the chip or shaving upon the tool; (l) the changes of speed and feed possible in the lathe; (m) the pulling and feeding power of the lathe.

Broadly speaking, the problem of studying the effect of each of the above variables upon the cutting speed and of making this study practically useful, may be divided into four sections as follows:

(A) the determination by a series of experiments of the important facts or laws connected with the art of cutting metals. (B) the finding of mathematical expressions for these laws which are so simple as to be suited to daily use. (C) the investigation of the limitations and possibilities of metal cutting machines. (D) the development of an instrument (a slide rule) which embodies, on the one hand, the laws of cutting metals, and on the other, the possibilities and limitations of the particular lathe or planer, etc., to which it applies and which can be used by a machinist without mathematical training to quickly indicate in each case the speed and feed which will do the work quickest and best.

Experiments Planned for Six Months Last 26 Years.

In the fall of 1880, the machinists in the small machine shop of the Midvale Steel Co., Philadelphia, most of whom were working on piecework in machining locomotive tires, car axles, and miscellaneous forgings, had combined to do only a certain number of pieces per day on each type of work. The writer, who was the newly appointed foreman of the shop, realized that it was possible for the men to do in all cases much more work per day than they were accomplishing. He found, however, that his efforts to get the men to increase their output were blocked by the fact that his knowledge of just what combination of depth of cut, feed and cutting speed would in each case do the work in the shortest time, was much less accurate than that of the machinists who were combined against him. His conviction that the men were not doing half as much as they should do, however, was so strong that he obtained the permission of the management to make a series of experiments to investigate the laws of cutting metals with a view to obtaining a knowledge at least equal to that of the combined machinists who were under him. He expected that these experiments would last not longer than six months. With the exception of a few comparatively short periods, however, these experiments have continued until the present time, through a term of about 26 years.

Fortunate Circumstances Attended Experiments.

The writer wishes to call attention to the fact that in these first experiments he was far more fortunate than almost all of the experimenters who have investigated the subject since then, in having at his disposal a comparatively large mass of uniform metal to work upon, and a comparatively large and powerful machine to work with, a 66-inch diameter boring mill and large locomotive tires made of hard tire steel of uniform quality having been used. He was also especially fortunate in having over him as president of the company, William Sellers, who, as is well known, was one of the most patient and broad-minded experimenters of his day. Mr. Sellers, in spite of the protests which were made against the continuation of this work, allowed the experiments to proceed; even, at first, at a very considerable inconvenience and loss to the shop. The extent of this inconvenience will be appreciated when it its understood that we were using a 66-inch diameter vertical boring mill, belt-driven by the usual cone pulleys, and that in order to regulate the exact cutting speed of the tool, it was necessary to slow down the speed of the engine that drove all of the shafting in the shop; a special adjustable engine governor having been bought for this purpose. For over two years the whole shop was inconveni-

[1]Abstract of the Presidential address at the New York Meeting (December, 1906) of The American Society of Mechanical Engineers.

enced in this way, by having the speed of its main line of shafting greatly varied, not only from day to day but from hour to hour. Before the two years had elapsed, however, the writer had obtained such valuable and unexpected results from the experiments as to much more than justify all of the annoyance and expenditure, and soon after that he readily obtained permission to employ a young technical graduate to devote his whole time to the continuation of this work.

G. M. Sinclair, a graduate of Stevens Institute of Technology, devoted his entire time to this work from 1884 to 1887, when he left the employ of the company. H. L. Gantt, also a graduate of Stevens Institute succeeded Mr. Sinclair in July, 1887, and has been interested with us in carrying on these experiments throughout their whole period. In 1898 Maunsel White, of Bethlehem, another graduate of Stevens Institute, joined us and has been actively interested in our work up to this time. Carl G. Barth, a graduate of the Technical School of Horten, Norway, joined us in 1899, and is still actively working on our investigations.

In addition to the five men who have mainly directed and carried on this work, the writer wishes to acknowledge the most loyal and efficient aid and co-operation of many others who have assisted in the actual running of the machines and in recording and tabulating the data.

Our experiments were continued in the works of the Midvale Steel company until 1889, when the writer left their employ. Since then, these investigations have been carried on in various shops and at the expense of different companies. Among these, we would especially acknowledge our indebtedness to the Cramp's Shipbuilding company, Messrs. Wm. Sellers & Co., the Link-Belt Engineering company, Messrs. Dodge & Day, and, more than all, to the Bethlehem Steel company.

Experimental Cost Large but More than Repaid.

In carrying on this work more than ten machines have been fitted up at various times with special driving apparatus and the other needed appliances, all machines used since 1894 having been equipped with electric drives, so as to obtain any desired cutting speed. The thoroughness with which the work has been done may perhaps be better appreciated when it is understood that we have made between thirty and fifty thousand recorded experiments, and many others of which no record was kept. In studying these laws we have cut up into chips with our experimental tools more than 800,000 pounds of steel and iron. More than sixteen thousand experiments were recorded in the Bethlehem Steel Co. We estimate that up to date between $150,000 and $200,000 has been spent upon this work, and it is a very great satisfaction to feel that those whose generosity has enabled us to carry on the experiments have received ample return for their money through the increased output and the economy in running their shops which have resulted from our experiments.

Progress of the Investigation.

The writer has no doubt that many of the discoveries and conclusions which mark the progress of this work have been and are well known to other engineers, and we do not record them with any certainty that we were the first to discover or formulate them, but merely to indicate some of the landmarks in the development of our own experiments, which to us were new and of value. The following is a record of some of our more important steps:

(A) In 1881, the discovery that a round-nosed tool could be run under given conditions at a much higher cutting speed and therefore turn out much more work than the old-fashioned diamond-pointed tool.

(B) In 1881, the demonstration that, broadly speaking, the use of coarse feeds accompanied by their necessarily slow cutting speeds would do more work than fine feeds with their accompanying high speeds.

(C) In 1883, the discovery that a heavy stream of water poured directly upon the chip at the point where it is being removed from the steel forging by the tool, would permit an increase in cutting speed, and, therefore, in the amount of work done of from 30 to 40 per cent.

(D) In 1883, the completion of a set of experiments with round nosed tools; first, with varying thicknesses of feed when the depth of the cut was maintained constant; and, second, with varying depths of cut while the feed remained constant, to determine the effect of these two elements on the cutting speed.

(E) In 1883, the demonstration of the fact that the longer a tool is called upon to work continuously under pressure of a shaving, the slower must be the cutting speed, and the exact determination of the effect of the duration of the cut upon the cutting speed.

(F) In 1883, the development of formulae which gave mathematical expression to the two broad laws above referred to. Fortunately these formulae were of the type capable of logarithmic expression and therefore suited to the gradual mathematical development extending through a long period of years, which resulted in making our slide rules, and solved the whole problem in 1901.

(G) In 1883, the experimental determination of the pressure upon the tool required on steel tires to remove cuts of varying depths and thickness of shaving.

(H) In 1883, the starting of a set of experiments on belting.

(J) In 1883, the measurement of the power required to feed a round-nosed tool with varying depths of cut and thickness of shaving when cutting a steel tire. This experiment showed that a very dull tool required as much pressure to feed it as to drive the cut. This was one of the most important discoveries made by us, and as a result all steel cutting machines purchased since that time by the Midvale Steel Co. have been supplied with feeding power equal to their driving power and very greatly in excess of that used on standing machine tools.

(K) In 1884, the design of an automatic grinder for grinding tools in lots and the construction of a tool room for storing and issuing tools ready ground to the men.

(L) From 1885 to 1889, the making of a series of practical tables for a number of machines in the shops of the Midvale Steel Co., by the aid of which it was possible to give definite tasks each day to the machinists who were running machines, and which resulted in a great increase in their output.

(M) In 1886, the demonstration that the thickness of the chip or layer of metal removed by the tool has a much greater effect upon the cutting speed than any other element, and the practical use of this knowledge in making and putting into everyday use in our shops a series of broad-nosed cutting tools which enabled us to run with a coarse feed at as high a speed as had been before attained with round-nosed tools when using a fine feed, thus substituting, for a considerable portion of the work, coarse feeds and high speeds for our old maxim of coarse feeds and slow speeds.

(N) In 1894 and 1895, the discovery that a greater proportional gain could be made in cutting soft metals through the use of tools made from

self-hardening steels than in cutting hard metals, the gain made by the use of self-hardening tools over tempered tools in cutting soft cast iron being almost 90 per cent, whereas the gain in cutting hard steels or hard cast iron was only about 45 per cent. Up to this time, the use of Mushet and other selfhardening tools had been almost exclusively confined to cutting hard metals, a few tools made of Mushet steel being kept on hand in every shop for special use on hard castings or forgings which could not be cut by the tempered tools. This experiment resulted in substituting self-hardening tools for tempered tools for all "roughing work" throughout the machine shop.

(P) In 1894 and 1895, the discovery that in cutting wrought iron or steel a heavy stream of water thrown upon the shaving at the nose of the tool produced a gain in cutting speed of self-hardening tools of about 33 per cent. Up to this time the makers of self-hardening steel had warned users never to use water on the tools.

(Q) From 1898 to 1900, the discovery and development of the Taylor-White process of treating tools; namely, the discovery that tools made from chromium-tungsten steels when heated to the melting point would do from two to four times as much work as other tools.

(R) In 1899-1902, the development of our slide rules, which are so simple that they enable an ordinary workman to make practical and rapid everyday use in the shop of all the laws and formulae deduced from our experiments.

(S) In 1906, the discovery that a heavy stream of water poured directly upon the chip at the point where it is being removed from cast iron by the tool would permit an increase in cutting speed, and therefore, in the amount of work done, of 16 per cent.

(T) In 1906, the discovery that by adding a small quantity of vanadium to tool steel to be used for making modern high speed chromium-tungsten tools heated to near the melting point, the hardness and endurance of tools, as well as their cutting speeds, are materially improved.

Evolving of "Slide Rules" Keynote of Success.

While many of the results of these experiments are both interesting and valuable, we regard as of by far the greatest value that portion of our experiments and of our mathematical work which has resulted in the development of the slide rules, i. e., the patient investigation and mathematical expression of the exact effect upon the cutting speed of such elements as the shape of the cutting edge of the tool, the thickness of the shaving, the depth of the cut, the quality of the metal being cut and the duration of the cut, etc. This work enables us to fix a daily task with a definite time allowance for each workman who is running a machine tool, and to pay the men a bonus for rapid work.

The gain from these slide rules is far greater than that of all the other improvements combined, because it accomplishes the original object, for which in 1880 the experiments were started, i. e., that of taking the control of the machine shop out of the hands of the many workmen and placing it completely in the hands of the management, thus superseding "rule of thumb" by scientific control.

Types of Experiments and Involved Errors.

In the investigation of an art such as that of cutting metals, and about which at the time our work was started there was so little scientific knowledge, two types of experiments are possible. First, the thoroughly scientific type, in which, after an analysis of all the variable elements which affect the final result, an attempt is made to hold all of the elements constant and uniform, except the one variable which is under investigation, and this one is systematically changed and its effect upon the problem carefully noted. It is to this type that our experiments belong. Second, the type of experiments in which the effect of two or more variables upon the problem is investigated at the same time and in the same experiment. This method is of course much quicker than the thoroughly scientific type, and it is largely for this reason, in the opinion of the writer, that almost all of the other experimenters in this field have chosen it. Several of the experiments of this type have proved most valuable and developed much useful information, and it is with hesitancy that the writer criticises the work of any of these experimenters, since he appreciates most keenly the difficulties under which they worked, and is grateful for the information contributed by them to the art. After much consideration, however, he has decided to point out what he believes to be a few errors made by these experimenters, with the same object which he has in indicating our own false steps: namely, that of warning future investigators against similar errors.

Almost the whole course of our experiments is marked by imperfections in our methods, which, as we have realized them, have led us to go again more carefully over the ground previously traveled. These errors may be divided into three principal classes: (A) The adoption of wrong or inadequate standards for measuring the effect of each of the variables upon the cutting speed. (B) Failure on our part from various causes to hold all of the variables constant except the one which was being systematically changed in order to study the effect of these changes upon the cutting speed. (C) The omission either through oversight or carelessness on our part of some one of the precautions which should be taken to insure accuracy, or failure to record some of the phenomena considered unimportant at the time, but which afterward proved to be essential to a complete understanding of the facts.

Determining Effect of Each Variable From Cutting Speed.

The effect of each variable upon the problem is best determined by finding the exact rate of cutting speed (say, in feet per minute) which shall cause the to be completely ruined after having been run for 20 minutes under uniform conditions. For example, if we wish to investigate the effect which a change in the thickness of the feed has upon the cutting speed, it is necessary to make a number of tools which are in all respects uniform, as to the exact shape of their cutting edge, their clearance and lip angles, their chemical composition and their heat treatment. These tools must then be run one after another, each for a period of 20 minutes, throughout which time the cutting speed is maintained exactly uniform. Each tool should be run at a little faster cutting speed than its predecessor, until that cutting speed has been found which will cause the tool to be completely ruined at the end of 20 minutes (with an allowance of a minute or two each side of the 20-minute mark). In this way that cutting speed is found which corresponds to the particular thickness of shaving which is under investigation.

A change is then made in the thickness of the shaving, and another set of 20-minute runs is made, with a series of similar uniform tools, until the cutting speed corresponding to the new thickness of feed has been determined; and by continuing in this way all of the cutting speeds are found which correspond to the various changes of feed. In the meantime, every precaution must be taken to maintain uniform all the other elements or variables which affect the

cutting speed, such as the depth of the cut and the quality of the metal being cut; and the rate of the cutting speed must be frequently tested during each 20-minute run to be sure that it is uniform.

The cutting speeds corresponding to varying feeds are then plotted as points upon a curve, and a mathematical expression is found which represents the law of the effect of feed upon cutting speed. We believe that this standard or method of procedure constitutes the very foundation of successful investigation in this art; and it is from this standpoint that we propose to criticise both our own experiments and those made by other investigators.

It was only after about 14 years' work that we found that the best measure for the value of a tool lay in the exact cutting speed at which it was completely ruined at the end of 20 minutes. In the meantime, we had made one set of experiments after another as we successively found the errors due to our earlier standards, and realized and remedied the defects in our apparatus and methods; and we have now arrived at the interesting though rather humiliating conclusion that with our present knowledge of methods and apparatus, it would be entirely practicable to obtain through four or five years of experimenting all of the information which we have spent 26 years in getting.

Time Lost Choosing Duration of Cut and Condition of Tool.

The following are some of the more important errors made by us: We wasted much time by testing tools for a shorter cutting period than 20 minutes, and then having found that tools which were apparently uniform in all respects gave most erratic results (particularly in cutting steel) when run for a shorter perior than 20 minutes; we erred in the other direction by running our tools for periods of 30 or 40 minutes each, and in this way used up in each single experiment so much of the forging that it was impossible to make enough experiments in cutting metal of uniform quality to get conclusive results. We finally settled on a run of 20 minutes as being the best all-round criterion, and have seen no reason for modifying this conclusion up to date.

We next thought a proper criterion for judging the effect of a given element upon the cutting speed lay in determining the particular cutting speed which would just cause a tool to be slightly discolored below the cutting edge at the end of the 20 minutes. After wasting six months in experimenting with this as our standard, we found that it was not a true measure; and then adopted as a criterion a certain definite dulling or rubbing away of the cutting edge. Later it was found, however, that each thickness of feed had corresponding to it a certain degree of dullness or injury to the cutting edge at which point regrinding was necessary (the thicker the shaving the duller the tool should be before grinding); and a third series of experiments was made with this as a standard. While experimenting on light forging a standard dullness of tool was used which was just sufficient to push the forging and tool apart and so slightly alter the diameter of the work. All of these criterions were discarded, however, when in 1894 we finally hit upon the true standard, above described, of completely ruining the tool in 20 minutes.

Important Elements Before Neglected.

Experiments upon the art of cutting metals (at least those experiments which have been recorded) have been mainly undertaken by scientific men, mostly by professors. It is but natural that the scientific man should lean toward experiments which require the use of apparatus and that type of scientific observation which is beyond the scope of the ordinary mechanic, or even of engineers unless they have been especially trained in this kind of observation. It is perhaps for this reason more than any other that in this art several of those elements which are of the greatest importance have received no attention from experimenters, while far less fruitful although more complicated elements, have been the subject of extended experiments.

As an illustration of this fact we would call attention to two of the most simple of all of the elements which have been left entirely untouched by all experimenters, namely: (a) the effect of cooling the tool through pouring a heavy stream of water upon it, which results in a gain of 40 per cent in cutting speed; (b) the effect of the contour or outline of the cutting edge of the tool upon the cutting speed, which when properly designed results in an equally large percentage of gain.

Both of these elements can be investigated at comparatively small cost and with compartively simple apparatus, while that element which has received chief attention from experimenters, namely, the pressure of the chip on the tool, calls for elaborate and expensive apparatus and is almost barren of useful results.

This should be a warning to all men proposing to make experiments in any field, first, to look thoroughly over the whole field, and, at least, carefully consider all of the elements from which any practical results may be expected; and then to select the more simple and elementary of these and properly investigate them before engaging in the more complicated work.

Other Investigations.

The most notable experiments in this art that have come to the writer's attention are those made at Manchester, England, during the years 1902 and 1903. All these experiments were made jointly by eight of the most prominent English manufacturing companies, among whom were Armstrong, Whitworth & Co., Vickers' Sons & Mixim, Ltd., John Brown & Co., Thomas Firth & Sons, and others, who combined with the Manchester Association of Engineers and the Manchester Municipal School of Technology, the latter being principally represented by Dr. J. T. Nicolson, who made the final report entitled "Experiments with a Lathe Tool Dynamometer," published in *Transactions*, Vol. 25.

In 1901, a committee of the Verein Deutscher Ingenieure (Union of German Engineers), together with the managers of some of the larger engineering works in Berlin, made an interesting series of experiments which was published September 28, 1901, in the *Zeitschrift des Verein Deutscher Ingenieure*, and on November 15, 1905, they were published in Bulletin No. 2 of the University of Illinois, experiments made by Prof. L. P. Breckinridge and Henry B. Dirks.

The work of all these men belongs to the second type of experiments above referred to, in which the joint effect of two or more variables is studied at the same time. In the case of the Manchester experiments, the work appears to have been, to a considerable extent, a test as to the all-round knowledge in the art of cutting metals possessed by eight of the prominent English firms. These firms each presented tools made from their own tool steel, treated their own way, and ground to whatever shapes and angles the particular company considered would do the largest amount of work.

As was to be expected from any such test, each one of the eight companies repeatedly made guesses as to the proper speeds for their tools to run which were very wide of the

mark. Yet in spite of this, it is notable that in each case some one of the eight firms guessed fairly close to the proper cutting speed, so that by selecting the best of these various guesses Dr. Nicolson, in writing the report, gives a very valuable and interesting table summarizing the best speeds attained in cutting the soft, medium and hard steels, and the soft, medium and hard cast irons experimented in, in each case with four combined changes of depth of cut and thickness of feed.

Data Valuable But Not Precise.

This table conclusively proves the practical value of experience of this nature, even when carried on in a thoroughly unscientific manner. There is, however, one element in these experiments which was very carefully investigated, and the results of which are of general scientific value; namely, the determination of the pressure of the chip or shaving upon the nose of the tool.

That the conclusions reached as to pressure are of value is due to the fact that upon this particular element, neither the shape of the tool nor the composition or treatment of the tool has very great effect, and in each case the pressure of the chip upon the tool appears to have been carefully observed and tabulated, so that experiments which are valueless from a scientific standpoint for most of the elements, confirm substantially, as to the pressure of the chip on the tool, the results of some of our previous experiments on this element.

The writer has a great respect for Dr. Nicolson as an experimenter, as his later work in this field has shown him to be a thoroughly scientific investigator; but feels it necessary to call attention to an error which even he has fallen into, namely, that of attempting to deduce a formulae for the cutting of metals from a summary of the Manchester and German experiments. These experiments, from a scientific standpoint, were so defective as to make it out of the question to deduce formulae, because no effort was made to keep the following variables uniform: (1) the shape of the cutting edge and the lip and clearance angles of the tool varied from one experiment to another; (2) the quality of the tool steel varied; (3) the treatment of the tool varied; (4) the depth of the cut varied from that aimed at; (5) the cutting speed was not accurately determined at which each tool would do its maximum work throughout a given period of time; and (6) in reading the report of these experiments it does not appear that any careful tests were made to determine whether each of the various forgings and castings experimented on was sufficiently uniform throughout in quality to render the tests made upon them of scientific value. The same criticism, broadly speaking, applies to both the German and the University of Illinois experiments.

In fact, in none of these sets of experiments have they appreciated the necessity of measuring separately the effect produced upon the cutting speed of two of the most important elements in the problem, (a) the thickness of the feed, and (b) the depth of the cut. In all of these investigations and in formulae given by Dr. Nicolson, summarizing the results of the Manchester and German experiments, the area of the cut "a" is used as though it were a single variable, whereas the sectional area of the shaving is, in fact, the product of the depth of the cut multiplied by the feed. The fact is, however, that the thickness of the shaving or the feed has a greater effect upon the cutting speed than any other element, while the depth of the cut has only a comparatively small effect. When this is realized, it becomes apparent that any formula or even any data containing the area of the cut (or shaving) as a single element is valueless from a scientific standpoint.

Broadly speaking, it is unwise to draw conclusions and make formulae from experiments in which more than one variable is allowed to vary in the same trial. This criticism is made in no sense to belittle the value of the work done by others, but with the object to pointedly call the attention of future experimenters to such errors as have been made primarily by ourselves and also by others.

Pressure a Troublesome Element.

The results obtained by Dr. Nicolson from the Manchester experiments led him to make another set of experiments for the purpose of determining accurately the pressure of the chip or shaving upon the cutting edge of the tool.

These experiments form a substantial and permanent addition to our knowledge of the art of cutting metals.

However, in choosing this element for investigation Dr. Nicolson made the same error (if such it may be called) into which almost every experimenter in this field falls sooner or later. From all theoretical standpoints it appears to the novice that a thorough investigation of the effect of the pressure of the chip upon the tool under varying conditions must furnish the key to the whole problem of the variation of cutting speed due to the varying feeds, depths of cut, shape of the tool, etc. The fact is, however, that every one who exploits this field finds out sooner or later that there is no traceable relation whatever between the pressure of the chip on the tool and the cutting speed, and but little connection even between the hardness of the metal and the pressure upon the tool.

This element in the art has constituted the pit into which so many experimenters have fallen; and upon failing to trace any scientific relation between the pressure and the cutting speed they are very apt to conclude that the whole subject of cutting metals belongs to the domain of "rule of thumb" rather than to that of exact science, and give up further work in this field.

It may almost be said that investigations heretofore made upon the general subject of the pressure of the chip upon the tool have proved barren of useful and practical results, except in so far as they have furnished the knowledge needed by tool builders for giving their machines the proper driving power. It is with little hesitation that the writer makes the assertion that if no experiments whatever had been made in this field, the knowledge of the art of cutting metals would be on the whole in a more advanced state than it is now, since experimenters in all countries instead of studying pressures would have given their attention to some one of the other lines of investigation which bear directly and yield valuable information upon the one most important subject of cutting speed.

Taylor-White Process.

The discovery of the Taylor-White process of treating tools by heating them almost to the melting point, or, in other words, the introduction of modern high-speed tools the world over, was the indirect result of one of our lines of investigation.

The demonstration of the fact that the rules of using belting in common practice furnished belts which were entirely too light for economy was also one of the indirect results of our experiments.

The manner of making these discoveries was each time in a way so typical of what may be expected in similar cases that it would seem worth while to describe it in some detail.

During the winter of 1894-1895, the

writer conducted an investigation in the shop of Wm. Sellers & Co., at the joint expense of Messrs. William Cramp & Sons, ship builders, and Messrs. Wm. Sellers & Co., to determine which make of self-hardening tool steel was, on the whole, the best to adopt as standard for all of the roughing tools of these two shops.

As a result of this work, the choice was narrowed down at that time to two makes of tool steel: (1) the celebrated Mushet self-hardening steel, and (2) a self-hardening steel made by the Midvale Steel Co. of the following chemical compositions:

	Tungsten Per Cent.	Chromium Per cent.	Carbon Per Cent.	Manganese Per Cent.	Silicon Per Cent.	Phosphorus Per Cent.	Sulphur Per Cent.
MIDVALE:	5.441	0.398	2.150	1.578	1.044		
MUSHET:	7.723	1.830	1.143	0.180	0.246	0.023	0.008

Of these two steels, the tools made from the Midvale steel were shown to be capable of running at rather higher cutting speeds. The writer himself heated hundreds of tools of these makes in the course of his experiments in order to accurately determine the best temperatures for forging and heating them prior to grinding so as to get the best cutting speeds. In these experiments he found that the Mushet steel if overheated crumbled badly when struck even a light blow on the anvil, while the Midvale steel if overheated showed no tendency to crumble, but, on the other hand, was apparently permanently injured. In fact, heating these tools slightly beyond a bright cherry red caused them to permanently fall down in their cutting speeds; and the writer was unable at that time to find any subsequent heat treatment which would restore a tool broken down in this way to its original good condition. This defect in the Midvale tools left us in doubt as to whether the Mushet or the Midvale was, on the whole, the better to adopt as a shop standard.

After testing several additional makes of tools, our experiments indicated that the Midvale self-hardening tools could be run if properly heated at slightly higher speeds than those of any other make.

Upon deciding to adopt this steel as our standard the writer had a number of tools of each make of steel carefully dressed and ground to exactly the same shape. He then called the foremen and superintendents of the machine shops of the Bethlehem Steel Co. to the experimental lathe so that they could be convinced by seeing an actual trial of all of the tools that the Midvale steel was, on the whole, the best. In this test, however, the Midvale tools proved to be worse than those of any other make; i. e., they ran at slower cuttng speeds.

It was of course the first impression of the writer that these tools had been overheated in the smith shop. Upon careful inquiry among the smiths, however, it seemed as though they had taken special pains to dress them at a low heat, although the matter was left in much doubt. The writer, therefore, determined to make a thorough investigation before finally adopting the Midvale steel as our shop standard to discover if possible some heat treatment which would restore Midvale tools injured in their heating (whether they had been underheated or overheated) to their original good condition.

Revelations Regarding Heating of Cutting Tools.

For this purpose Mr. White and the writer started a carefully laid-out series of experiments, in which tools were to be heated at temperatures increasing, say, by about 50 degrees all the way from a black heat to the melting point. These tools were then to be ground and run in the experimental lathe upon a uniform forging, so as to find:

(a) That heat at which the highest cutting speed could be attained (which our previous experiments had shown to be a cherry red); (b) to accurately determine the exact danger point at which if over or underheated these tools were seriously injured; (c) to find some heat treatment by which injured tools could be restored to their former high-cutting speeds.

These experiments corroborated our Cramp-Sellers experiments, showing that the tools were seriously broken down or injured by overheating, say, somewhere between 1,550 degrees Fahr. and 1,700 degrees Fahr.; but to our great surprise, tools heated up to or above the high heat of 1,725 degrees Fahr. proved better than any of those heated to the best previous temperature, namely, a bright cherry red; and from 1,725 degrees Fahr. up to the incipient point of fusion of the tools, the higher they were heated, the higher the cutting speeds at which they would run.

Thus, the discovery that phenomenal results could be obtained by heating tools close to the melting point, which was so completely revolutionary and directly the opposite of all previous heat treatment of tools, was the indirect result of an accurate scientific effort to investigate as to which brand of tool steel was, on the whole, the best to adopt as a shop standard; neither Mr. White nor the writer having the slightest idea that overheating beyond the bright cherry red would do anything except injure the tool more and more the higher it was heated.

Belting a Source of Inefficiency.

During our early Midvale Steel Co. experiments, extending from 1880 to 1883, the writer had so much trouble in maintaining the tension of the belt used in driving the boring mill upon which he was experimenting that he concluded: (1) that belting rules in common use furnished belts entirely too light for economy; and (2) that the proper way to take care of belting was to have each belt in a shop tightened at regular intervals with belt clamps especially fitted with spring balances, with which the tension of the belt was accurately weighed every time it was tightened, each belt being retightened each time to exactly the same tension.

In 1884, the writer designed and superintended the erection of a new machine shop for the Midvale Steel Co., and this gave him the opportunity to put these conclusions to a practical test. About half the belts in the shop were designed according to the ordinary rules and the other half were made about three times as heavy as the usual standard. This shop ran day and night. The belts were in all cases cared for and retightened only upon written orders sent from the shop office; and an accurate record was kept through nine years of all items of interest concerning each belt, namely, the number of hours lost through interruption to manufacture; the number of time each belt interrupted manufacture; the original cost of each belt; the detail costs of tightening, cleaning and repairing each belt; the fall in the tension before requiring retightening; and the time each belt would run without being retightened. Thus at the end of nine years these belts furnished a record which demonstrated beyond question many important facts connected with the use of belting, the principal of these being that the ordinary rules gave belts only about one-half as heavy as should be used for economy. This belting experiment illustrates again the good that often comes indirectly from experiments undertaken in an entirely different field.

The Machinist and the New Laws.

After many years of close personal

contact with our mechanics, I have great confidence in their good judgment and common sense in the long run, and I am proud to number many of them among my most intimate friends. As a class, however, they are extremely conservative, and if left to themselves their progress from the older toward better methods will be exceedingly slow. And my experience is that rapid improvements can only be brought about through constant and heavy pressure from those who are over them.

It must be said, therefore, that to get any great benefit from the laws derived from these experiments, our slide rules must be used, and these slide rules will be of but little, if any, value under the old style of management, in which the machinist is left with the final decision as to what shape of tool, depth of cut, speed and feed, he will use. The slide rules cannot be left at the lathe to be banged about by the machinist. They must be used by a man with reasonably clean hands, and at a table or desk, and this man must write his instructions as to speed, feed, depth of cut, etc., and send them to the machinist well in advance of the time that the work is to be done. Even if these written instructions are sent to the machinist, however, little attention will be paid to them unless rigid standards have been not only adopted, but enforced, throughout the shop for every detail, large and small, of the shop equipment, as well as for all shop methods. And, further, but little can be accomplished with these laws unless the old-style foreman and shop superintendent have been done away with, and functional foremanship has been substituted,—consisting of speed bosses, gang bosses, order-of-work men, inspector, time study men, etc. In fact, the correct use of slide rules involves the substitution of our whole task system of management for the old-style management.

A long time will be required in any shop to bring about this radically new order of things; but in the end the gain is so great that I say without hesitation that there is hardly a machine shop in the country whose output cannot be doubled through the use of these methods. And this applies not only to large shops, but also to comparatively small establishments. In a company whose employes all told, including officers and salesmen, number about one hundred and fifty men, we have succeeded in more than doubling the output of the shop, and in converting an annual loss of 20 per cent upon the old volume of business into an annual profit of more than 20 per cent upon the new volume of business, and at the same time rendering a lot of disorganized and dissatisfied workmen contented and hard working, by insuring them an average increase of about 35 per cent in their wages.

Standardization Means Simplification.

Too much emphasis cannot be laid upon the fact that standardization really means simplification. It is far simpler to have in a standardized shop two makes of tool steel than to have 20 makes of tool steel, as will be found in shops under the old style of management. It is far simpler to have all of the tools in a standardized shop ground by one man to a few simple but rigidly maintained shapes than to have, as is usual in the old-style shop, each machinist spend a portion of each day at the grindstone, grinding his tools with radically wrong curves and cutting angles, merely because bad shapes are easier to grind than good. Hundreds of similar illustrations could be given showing the true simplicity (not complication) which accompanies the new type of management.

A study of the recommendations made throughout this paper will illustrate the fact that we propose to take all of the important decisions and planning which vitally affect the output of the shop out of the hands of the workmen, and centralize them in a few men, each of whom is especially trained in the art of making those decisions and in seeing that they are carried out, each man having his own particular function in which he is supreme, and not interfering with the functions of other men. In all this let me say again that we are aiming at true simplicity, not complication.

Strength in Co-operation.

In concluding let me say that we are now but on the threshold of the coming era of true co-operation. The time is fast going by for the great personal or individual achievement of any one man standing alone and without the help of those around him. And the time is coming when all great things will be done by the co-operation of many men in which each man performs that function for which he is best suited, each man preserves his own individuality and is supreme in his particular function, and each man at the same time loses none of his originality and proper personal initiative, and yet is controlled by and must work harmoniously with many other men.

And let me point out that the most important lessons taught by these experiments, particularly to the younger men, are:

Several men when heartily co-operating, even if of everyday caliber, can accomplish what would be next to impossible for any one man even of exceptional ability.

Expensive experiments can be successfully carried on by men without money, and the most difficult mathematical problems can be solved by very ordinary mathematicians; providing only that they are willing to pay the price in time, patience and hard work.

The old adage is again made good that all things come to him who waits, if only he works hard enough in the meantime.

COLORADO FUEL & IRON CO. NEWS.

(Special Correspondence.)

Pueblo, Colo., Dec. 10.—The coal situation, which has been worrying the Colorado Fuel & Iron Co. for the past month, has been materially relieved and there is now sufficient incoming fuel for all the purposes of the plant. Arrangements were made with the railroad companies for better car and transportation facilities, hence the fuel famine is passed.

The new storage tank which was recently put in operation, is producing most satisfactory results. The tank is used for the storage of metal from the blast furnaces until it is called for by the open-hearth furnaces. It keeps the metal heated, instead of allowing it to cool in the old method, until it is required. The tank will mean a saving in fuel, although it requires an increase in working force. It has a capacity of 250 tons.

Blast furnace D will be shut down in a few days for some much-needed repairs. The furnace has been in continuous operation ever since the steel works resumed operation more than two years ago. The furnace will be thoroughly overhauled, relined and fitted with modern improvements. It will be shut down for three or four months.

A break in the usual routine of the steel works occurred last week when blast furnace A was blown in with a little more than the customary circumstances. Promptly at noon Miss Mary Dreher, stenographer in the office of General Manager McKennan, accompanied by the principal officials of the plant, pulled the whistle cord which announced to the engineer that all was in readiness for resumption. The furnace is scheduled for four heats a day, and will materially assist during the time furnace D is closed down.

Quiet Markets With Money Rates High.

In a market replete with important developments, yet dominated, as has often been the case during the past few months, by the money situation, industrial securities were only fairly active during the past week, and in most instances closed with little change. Notable exceptions were Republic Iron & Steel and Virginia Iron, Coal & Coke, both of which advanced sharply, the latter for a total of nine points, and Pullman, which went off eight points. Call money on Wednesday loaned at 32 per cent in New York and held high throughout the week, though the situation was somewhat improved by Secretary Shaw's offer to anticipate about $12,000,000 interest on the government debt. The bank statement of Saturday was the worst in a dozen years, showing that the New York Clearing House banks held $6,702,175 less reserve than required by law. The high interest rates made particularly pertinent a speech by Jacob H. Schiff declaring wide fluctuations of this sort intolerable, stating that they are oftentimes the result of deliberate manipulation and proposing measures for their regulation by the clearing house and stock exchange. Both the president's message and that of the secretary of the treasury were well received. Other developments included an increase in dividends of the Vanderbilt roads, the New York Central being placed on a six per cent basis, a movement to investigate the Harriman system, and the sale by the Pennsylvania railroad of a large block of Chesapeake & Ohio stock.

A tendency of the times found manifestation in the action of the directors of the American Car & Foundry Co., who at their regular meeting on Dec. 6, ordered a resumption of dividends on the common stock, declaring a quarterly dividend of ½ of 1 per cent. The usual quarterly dividend of 1¾ per cent was declared on the preferred stock. After the adjournment of the meeting President Eaton issued the following statement:

"As all of the plants are running to their fullest capacity, requiring the carrying of an amount of material much greater than heretofore, also as there is a necessity for increased working capital for starting up the new steel car plant at Madison, Ill., and a like amount will be required for starting the new steel car plant at St. Louis, with the necessary expenses for permanent improvements, an unusual demand is made on the resources of the company at the present time, which will explain the necessity of being conservative in deciding the rate of dividend on the common stock."

Recent dividend declarations include the following: General Electric Co., regular quarterly, 2 per cent, payable Jan. 15. Standard Screw Co., semi-annual 3 per cent on preferred and 2½ per cent on common, payable Jan. 1. Ingersoll-Rand Co., semi-annual 3 per cent on preferred, payable Jan. 1. Youngstown Sheet & Tube Co., 1½ per cent.

THE LEADING INDUSTRIAL SECURITIES.

	Closing Quotation Dec. 1.	Closing Quo. Dec. 8.	Changes	Date of 1906 Ann. Meet.	Par Value	Capital Outstanding	Dividend Basis	Dividend Being Paid	Dividend Date Last Div. Pay.
Allis-Chalmers Co	17⅛	16¾	− ⅜	Sept.	100	19,820,000		.....	.....
Allis-Chalmers preferred	45¾	44¾	−1		100	16,150,000	7 cum	.....	Feb., 1904
American Can	6	6¾	+ ⅜	Apr. 24	100	41,233,300		.....	.....
American Can preferred	55	55½	+ ½		100	41,233,300	7 cum	5 Q.	Oct., 1906
American Car and Foundry	45¼	44⅜	− ⅜	June 28	100	30,000,000		½ Q.	Jan., 1907
AmericanCar and Foundry preferred	101¾	102	+ ¼		100	30,000,000	2 n. c.	7 Q.	Jan., 1907
American Locomotive	76	74½	−1½	Oct. 16	100	25,000,000		1¾	Nov., 1906
American Locomotive preferred	111¾	111½	− ¼		100	24,100,000	7 cum	7 Q.	Oct., 1906
American Shipbuilding	77⅛	77	− ½	Oct. 2	100	7,600,000	4 n. c.	1 Q.	Dec. 1906
American Shipbuilding preferred	108	110	+2		100	7,900,000	7 n. c.	1¾ Q.	Nov. 1906
American Steel Foundries	10¾	11	− ½	Oct. 3	100	17,700,000		.....	
American Steel Foundries preferred	46½	48¼	+1¾		100	17,700,000	6 cum	.....	Aug., 1905
Barney & Smith	72	72	.....	June 5	100	1,000,000	4	4	Dec., 1906
Barney & Smith preferred	140	140	.....		100	2,500,000	8 cum	8 Q.	Dec., 1906
Bethlehem Steel	20	19	−1	April 3	100	15,000,000		.....	
Bethlehem Steel preferred	64	62⅛	−1⅞		100	15,000,000	7 n. c.	3 Q.	Nov., 1906
Bullock Electric preferred	112	112	.....	Oct. 2	100	1,000,000	6	6 Q.	Oct., 1906
Cambria Steel	38⅞	38¾	− ¼	March 20	50	45,000,000	6	3 Q.	Aug., 1906
Cambria Iron	48	47½	− ½		50	8,468,000	4	4 S. A.	Oct., 1906
Colorado Fuel & Iron	55	57¼	+2¼	Oct. 15	100	30,132,000	7	.....	Apr., 1902
Wm. Cramp & Sons Ship & Eng. Bldg. Co.	15	15	.....	May 31	100	6,098,000	5	.....	Nov., 1902
Crucible Steel	12½	12½	.....	Oct. 17	100	25,000,000		.....	
Crucible Steel preferred	80¾	80	− ¾		100	25,000,000	7 cum	.....	Sept., 1906
Empire Steel	5	8	+3	Feb. 28	100	2,281,400		.....	
Empire Steel preferred	42	43	+1		100	2,500,000	6 cum	3 S. A.	July, 1906
Fay & Egan	95	95	.....	Feb. 20	100	1,000,000	6	6 Q.	Nov., 1906
Fay & Egan preferred	128½	128½	.....		100	1,000,000	7 cum	7 Q.	Nov., 1906
General Electric		162⅝	.....	May 8	100	48,256,050	8	8 Q.	Jan., 1907
International Pump	40½	41⅜	+1⅛	June 5	100	12,282,500		2	July, 1905
International Pump preferred	81	81⅛	+ ⅛		100	8,850,000	6 cum	6 Q.	Nov., 1906
Lackawanna Steel	71	71	.....	March 14	100	34,971,400		.....	
Lake Superior Corporation	14¾	15	+ ¼	Oct. 3	100	40,000,000		.....	
Niles-Bement-Pond	130	130	.....	Feb. 7	100	5,000,000	6	6 Q.	Sept, 1906
Niles-Bement-Pond preferred	105	105	.....		100	2,000,000	6 cum	6 Q.	Dec., 1906
Otis Elevator Co	50	50	.....	March 19	100	6,350,300		2 A.	Apr., 1906
Otis Elevator Co. preferred	96	97	+1		100	5,589,500	6 n. c.	6 Q.	Oct., 1906
Pittsburg Coal Co	16¾	17⅝	+1⅜	Feb. 12	100	30,135,000		.....	
Pittsburg Coal preferred	58½	60⅞	+2⅜		100	30,716,200	7	.....	Apr., 1905
Pressed Steel Car	55⅞	54½	− ⅜	Feb. 21	100	12,500,000		3	Aug., 1904
Pressed Steel Car preferred	99½	99¼	− ¼		100	12,500,000	7 n. c.	7 Q.	Nov., 1906
Pullman Palace Car	189	181	−8	Oct. 18	100	74,000,000		8 Q.	Oct., 1906
Railway Steel Spring	57	56	−1	March 1	100	13,500,000		4 S. A.	Oct., 1905
Railway Steel Spring preferred	100½	99½	−1		100	13,500,000	7 cum	7 Q.	Dec. 1906
Republic Iron & Steel	38	41⅜	+3⅜	Oct. 17	100	27,352,000		.....	
Republic Iron & Steel preferred	101	102	+1		100	20,852,000	7 cum	7 Q.	Jan., 1907
Sloss-Sheffield	76	76⅛	+ ⅛	March 14	100	7,500,000	5	5	Oct., 1906
Sloss-Sheffield preferred	104	104	.....		100	6,700,000	7 n. c.	7 Q.	Oct , 1906
Tennessee Coal & Iron	163½	165	− ½	May 15	100	22,552,800		4 Q.	Nov., 1906
U. S. Cast Iron Pipe & Foundry	46	44⅜	−1⅝	June 27	100	12,500,000		2	Dec., 1906
U. S. Cast Iron Pipe & Foundry preferred	86⅝	84	−2½		100	12,500,000	7 n. c.	7	Dec., 1906
U. S. Steel	48	48¾	+ ⅜	April 16	100	508,302,500	2 n. c	½ Q.	Oct., 1906
U. S. Steel preferred	105	104⅞	− ⅛		100	360,281,100	7 cum	7 Q.	Nov., 1906
U. S. Steel 5's	97	97⅝	+ ⅝		100	463,798,000	5	5 A.	
Virginia Iron, Coal & Coke	80¾	89½	+9	Sept. 18	100	8,641,600		.....	
Westinghouse Electric	150⅛	154	+3⅛	June 27	50	20,996,350	10	10 Q.	Oct. 1906
Westinghouse Air Brake	162⅞	164	+1⅛	Oct. 2	50	10,990,450	30	30 Q.	Oct., 1906

NEWS FROM MANY INDUSTRIES.

New Buyers:—

The Locomotive Improvement Co., Clinton, Ia., has been incorporated to deal in improvements to locomotives and other railway appliances, to buy, manufacture and sell the same. The capital stock of the company is $12,000, and the incorporators are: Charles Markel, L. W. Barker, Oscar Jensen, J. H. Dunham and A. P. Barker.

The Portland Tool Works, Portland Ore., has been organized with a capitalization of $4,200 by W. Irving Spencer, Charles F. Machen and Patrick Dowd.

Curtis & Co. Mfg. Co., St. Louis, Mo., manufacturing saw mills and air hoists, has increased its capital stock from $250,000 to $500,000.

The Elite Foundry Co., Milwaukee, Wis., has been incorporated with a capital of $10,000 by John Houdek, Antoine Dishneau and E. I. Dishneau.

The Mitchell-Parks Mfg. Co., Belleville, Ill., has increased its capital stock to $100,000.

The Bagley-Willoughby Engine Co. has been organized with a capital stock of $50,000 to manufacture engines, motors, boats, etc. The incorporators are: George H. Bagley, 60 Sunnyside avenue; John G. Watson, 1174 Halsey street, and William H. Hein, 42 Stewart street, all of Brooklyn.

The Licking Coal & Iron Co. has been incorporated under Kentucky laws for $250,000 by J. C. Droege, F. J. Droege and W. J. Droege, all of Covington, Ky.

The Foote-Burt Co., Cleveland, has been organized with a capitalization of $150,000 by Frank H. Ginn, Joseph Hidy, John M. Garfield, Gardner Abbott and F. C. Newcomer to manufacture and deal in machinery.

The Hewitt Mfg. Co., Milwaukee, Wis., has been incorporated with a capital stock of $100,000 by Charles H. Duback, Charles H. Schoff and William E. Liebau. C. M. Hewitt will be president of the company, which takes over a long established brass and bronze foundry business.

The Cincinnati Iron Store Co., Cincinnati, O., has increased its capital stock from $100,000 to $300,000.

The Cast Iron Brazing Co., brazing cast iron, has been incorporated with a capital stock of $12,000. The incorporators are: Charles B. Potter, Nathaniel R. Potter and Helen M. Hall, all of Rochester, N. Y.

New Construction:—

The Crucible Steel Co. of America is making extensive improvements at its Harrison, N. J., works. These include the installation of a 15-ton acid open-hearth furnace with gas producer.

The Spring Steel & Wire Fence Co., Anderson, Ind., has completed arrangements for the erection of a branch plant at Coffeyville, Kan. The branch will be capitalized at $75,000, of which $50,000 will be paid in, the business men of Coffeyville being among the stockholders. Four buildings with an office will make up the plant, which will be in charge of E. T. Ireland, now connected with the Anderson plant. Extensive improvements are planned at Anderson for next summer.

The Atlantic Insulated Wire & Cable Co., Stamford, Conn., which recently lost its plant by fire, has awarded contracts for new buildings which it expects to occupy early in the new year.

The Page-Storm Drop Forging Co., Springfield, Mass., it is reported, will leave that city and will erect a large plant at Chicopee Falls, Mass. Plans are now being prepared.

A new foundry and ornamental iron department 100 x 150 feet will be erected by the Sunset Iron Works, Los Angeles. The product of the plant will be castings and ornamental iron work.

The improvements contemplated by the Florence Iron Works, Florence, N. J., will increase the output of its pipe foundry and enable it to make larger pipe than at present. Other important changes now contemplated may be consummated in the spring.

The Philadelphia Pipe Co., Bristol, Pa., has begun the erection of a foundry building. When complete the plant will represent an expenditure of about $75,000.

The Arthur Koppel Co., Chicago, has leased a tract of ground on Thirty-eighth street, and will build a warehouse for the storage of railroad supplies.

The Vulcan Iron Works, Ltd., Winnipeg, Man., has completed a brick and stone pattern shop.

The H. Wetter Mfg. Co., South Pittsburg, Tenn., is making an important addition to its foundry. The building will be 58 x 138 feet and will be equipped for the manufacture of soil pipe and fittings.

The R. Herschel Mfg. Co. is preparing to start operations in its new plant at Peoria, Ill., and in the spring will erect additional buildings and install a drop forging department, enabling it to make a specialty of a patent mining coupler.

The Lorain Steel Co., Philadelphia, is arranging to make extensive additions to its plant at Johnstown, Pa. It is stated that new construction work will involve about $200,000. The company recently occupied the extension to its steel foundry building 54 x 180 feet.

The Norton Grinding Co., Worcester, Mass., is planning extensive additions to its works, including the erection of a new building, 86 x 278 feet, one story, to be a duplicate of the present shop.

John K. Stewart, president of the Chicago Flexible Shaft Co., has purchased 189 feet frontage on Wells street, Chicago, and it is understood that a large warehouse will eventually occupy the site.

The Standard Foundry Co., Cleveland, has let the contract for additions to its plant.

The Baldt Steel Co., New Castle, Del., has prepared plans and secured governmental permission for the construction of a pier 800 feet long and 100 feet wide reaching out into the Delaware river.

The Contractors' Casting & Machine Co., Buffalo, is erecting a foundry building at Hertel and Elmwood avenues.

The Schoen Steel Wheel Co., Pittsburg, is completing the installation of eight large regenerative heating furnaces at its McKees Rocks works. These, in connection with other extensive improvements and additions which have been made to the plant, will ultimately result in the doubling of its present capacity.

The American & British Mfg. Co., Providence, R. I., builder of steam and combustion engines, is planning important additions, which will require considerable new equipment, including cranes, machine tools, etc. The additions will include one building 104 x 250 feet, and another 40 x 420 feet. Later on a new foundry and a large erecting shop for the Diesel engine department will be erected.

The McDonough Mfg. Co., Eau Claire, Wis., is planning to erect a new foundry, install additional machinery and make other improvements in the spring.

The United Iron Works Co., Springfield, Mo., states that contracts have been closed for the machinery required in its new boiler shop at Iola, Kan.

The Waterbury Brass Co., Waterbury, Conn., has begun work on extensive improvements which will include a large casting shop and some other construction work.

The Chester Steel Casting Co., Ches-

ter, Pa., has let the contract for an extension to its open-hearth foundry.

The Chapman Valve Mfg. Co., Indian Orchard, Mass., will increase its capitalization from $600,000 to $800,000 in order to care for extensive new construction work and other improvements.

The Fort Pitt Malleable Iron Co., Pittsburg, is installing at its works at McKees Rocks a 10-ton open-hearth furnace. A 100-foot extension is being made to the foundry and the necessary equipment installed to increase the capacity of the works about one-third.

The Globe Rolling Mill Co., of Cincinnati, has completed a large addition to its warehouses in which it will carry all sizes of machinery steel, spindle steel, etc., in order to accommodate the increasing demands in this line.

General Industrial Notes:—

The Cleveland Castings Pattern Co., Cleveland, recently incorporated, succeeds to the business of the Gobeille Pattern Co. Its officers are as follows: F. W. Wood, president; A. K. Spencer, vice president; D. G. Miller, secretary and treasurer, and V. G. Farner, superintendent.

W. E. Kane, of Kane & Roach, Syracuse, N. Y., has purchased the business of the Falknau-Sinclair Machine Co., Philadelphia, and will remove the plant of the latter concern to Syracuse. A wide range of metalworking machinery was manufactured at Philadelphia.

The formation of the Potter Ore Co. has completed the transfer of the Potter iron properties in Red Mountain, Ala., to the Tennessee Coal, Iron & Railroad Co. and the Republic Iron & Steel Co. The new company has issued $700,000, in 25-year five per cent bonds guaranteed by the Republic-Tennessee companies, and this, in addition to $100,000 cash, was the price of purchase. F. H. Crockard, connected with the Tennessee-Republic interests, is president of the ore company.

The Brown-Ketcham Iron Works, Indianapolis, manufacturing structural and ornamental iron and steel, has opened a branch office at 918 Park building, Pittsburg, with John R. Keers in charge.

The old tube plant of the Shelby Tube Co., at Toledo, O., and 10 acres of adjoining land have been sold to Isaac Gerson, of that city, for about $30,000.

The Fuller Mfg. Co., recently incorporated, will not locate at New Haven, Conn., until some time during the spring, as the property which it has acquired will be occupied until that time.

Charles J. Harrah Jr., president of the Midvale Steel Co., Nicetown, Pa., has obtained a favorable decision in the Orphan's Court, Philadelphia, sustaining his contention that about the $650,000 worth of stock in the company should remain undisturbed in the Harrah estate, thus preventing control from passing outside. A nephew sought to have this legacy distributed.

November iron ore shipments through the canals at Sault Ste. Marie totaled 3,456,053 tons.

The Fort Wayne Rolling Mill Co., Fort Wayne, Ind., which a year ago purchased the plant and assets of the bankrupt Fort Wayne Iron & Steel Co., has operated the business during the past year on a paying basis.

The Walsh Governor Co., LaPorte, Ind., was recently incorporated to take over the business heretofore operated as a co-partnership. An improved engine governor is manufactured, and present facilities are adequate. This company has been incorrectly referred to as the Welsh Governor Co.

Options have been given on the plant of the N. L. Hayden Mfg. Co., Columbus, O., and will probably be taken advantage of by an iron and steel concern of that city. The company manufactures metallic packing and other railway supplies and for several years has been perfecting an automatic stocker for locomotives. The options run for 30 days and are at par, the capitalization of the company being $100,000. N. L. Hayden is general manager.

The Penn Shovel Mfg. Co., Warren, O., has added to its directory board Cray Hanna and C. W. Young, of Poplar Bluff, Mo.; Charles A. Day and William Wilkoff, of Youngstown, O. The capitalization of the company has been increased from $150,000 to $350,000 to provide for consolidation with the Hanna-Young Handle Co. and for the erection of a rolling mill.

Trade Notes:—

The Piqua Blower Co., Piqua, O., formerly the Piqua Foundry & Machine Co., is installing a considerable amount of new machinery and enlarging its equipment for the better handling of its output of positive blowers. The increased demand for this blower has led the company to make a specialty of its manufacture.

The Midvale Steel Co., of Philadelphia, has ordered from the Allis-Chalmers Co. a heavy duty cross compound engine, with cylinder 30 x 46 x 48 inches, for direct connection to an electric generator, to be installed in its plant at Nicetown, Pa. As this unit will be subjected to extreme overloads during its ordinary operation, the engine is required to be very strongly built. It is to be operated non-condensing and the normal capacity of the unit will be 1,000 K. W.

The St. Louis Car Co., St. Louis, is building 61 all-steel cars for the New York Central for use in the subway. Six of them are finished and all will be delivered by March 1. Three sleeping cars of the American Palace type are under construction for the Pere Marquette. The company is now at work on contracts for 250 trolley cars for Los Angeles, 250 for San Francisco, 150 for Boston and several hundred for South American cities.

The B. F. Sturtevant Co., Boston, among recent sales of generating sets, reports one to the Silver Bros. Iron Works Co., Salt Lake City, Utah. An enclosed forced lubrication engine and other equipment goes to the same company.

The Oliver Iron Mining Co. has ordered 27 switching locomotives from the American Locomotive Co., and 22 locomotives from the Baldwin works, all are for use on the Mesabi range.

The Canton Boiler & Engineering Co., Canton, O., reports the sale of one 5,000 horsepower feed water heater and purifier, to be installed at the plant of the Berger Mfg. Co., Canton, to care for its increased power capacity. The same company will install a 300-horsepower heater at the plant of the American Roll & Foundry Co., Canton.

The B. F. Stutevant Co., Boston, is installing complete equipments of the blower system of heating and ventilation in the 18-stall round house of the Canadian Pacific Railway Co., Broadview, Saskatchewan, P. Q., and in the car repair shops of the Somerset Railway Co., Oakland, Me. It is also installing forge shop equipment for the National Rolling Mills, McKeesport, Pa., and mechanical draft installation for the American Locomotive Co., Dunkirk, N. Y.

The Best Mfg. Co., Pittsburg, has received a large contract for mill piping for the new plant of the Indiana Steel Co., at Gary. The aggregate will be about 25,000 tons. The company has also recently secured a number of other large orders.

The Union Electric Light & Power Co., of St. Louis, through its president, John I. Beggs, has placed an order with the Fred M. Prescott Steam Pump Co., Milwaukee, for what, it is stated, will be the largest boiler feed pump in the world.

The firm of John F. Allen, 370-372 Gerard avenue, New York City, is in receipt of an order from the American Car & Foundry Co. for six Allen compression lever riveters to be used in its new plant in St. Louis. This is part of an equipment of fifteen riveters for the same plant, the balance of which will be ready for shipment by the first of January.